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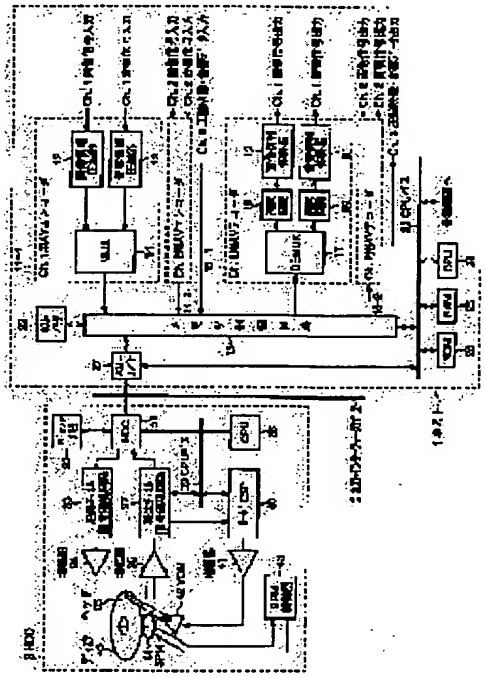
(54) DEVICE AND METHOD FOR DRIVING RECORDING MEDIUM, SYSTEM AND METHOD FOR INFORMATION RECORDING AND REPRODUCING AND PROVIDING MEDIUM

(57)Abstract:
PROBLEM TO BE SOLVED: To record and reproduce continuous AV data to and from a hard disk drive in a real time.
SOLUTION: The CPU 24 of a host 1 makes an access to an HDD 3 through a host interface bus 2 to continuously record and reproduce AV data onto or from a disk 45. Thus, if there exists an error in the operation of recording or reproducing, a maximum allowable time or a maximum allowable number of times of re-executions is controlled by the CPU 24 of the host 1, not by the HDD 3.



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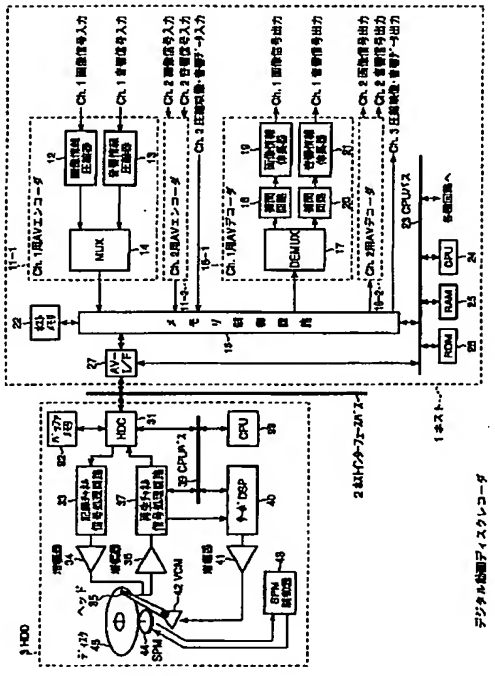
(54)【発明の名称】　記録媒体駆動装置および方法、情報記録再生システムおよび方法、並びに提供媒体

(57)【要約】
【課題】　連続するAVデータを、ハードディスクドライブに実時間で記録再生できるようにする。
【解決手段】　ホスト１のCPU２４は、ホストインタフェースバス２を介してHDD３にアクセスし、AVデータをディスク４５に連続的に記録または再生させる。HDD３ではなく、ホスト１のCPU２４によりシーク、記録または再生の動作に誤りがある場合の再実行の最大許容時間または最大許容回数が制御される。



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【特許請求の範囲】

【請求項１】 情報処理装置に接続され、前記情報処理装置から供給される連続する画像情報または音響情報を、内蔵する記録媒体に記録し、前記記録媒体から再生した前記情報を前記情報処理装置に出力し、かつ、シーク、記録または再生の動作に誤りがあった場合、その動作を再実行する記録媒体駆動装置において、

前記情報処理装置が出力する、前記再実行を制御する制御信号を受信する制御信号受信手段と、

前記情報処理装置が出力する前記制御信号に基づいて、前記再実行を制御する再実行制御手段とを備えることを特徴とする記録媒体駆動装置。

【請求項２】 前記再実行による遅延時間を前記情報処理装置に送信する遅延時間送信手段をさらに備えることを特徴とする請求項１に記載の記録媒体駆動装置。

【請求項３】 前記再実行制御手段は、前記再実行の最大許容回数または最大許容時間を制御することを特徴とする請求項１に記載の記録媒体駆動装置。

【請求項４】 前記再実行の最大許容回数は、記録または再生の動作に誤りがある場合より、シークの動作による誤りがある場合の方が大きいことを特徴とする請求項３に記載の記録媒体駆動装置。

【請求項５】 前記再実行の最大許容時間は、記録または再生の動作に誤りがある場合より、シークの動作による誤りがある場合の方が長いことを特徴とする請求項３に記載の記録媒体駆動装置。

【請求項６】 前記再実行の最大許容回数または最大許容時間は、前記シーク、記録または再生の動作中に動的に変化することを特徴とする請求項３に記載の記録媒体駆動装置。

【請求項７】 情報処理装置に接続され、前記情報処理装置から供給される連続する画像情報または音響情報を、内蔵する記録媒体に記録し、前記記録媒体から再生した前記情報を前記情報処理装置に出力し、かつ、シーク、記録または再生の動作に誤りがあった場合、その動作を再実行する記録媒体駆動装置の記録媒体駆動方法において、

前記情報処理装置が出力する、前記再実行を制御する制御信号を受信する制御信号受信ステップと、

前記情報処理装置が出力する前記制御信号に基づいて、前記再実行を制御する再実行制御ステップとを含むことを特徴とする記録媒体駆動方法。

【請求項８】 情報処理装置に接続され、前記情報処理装置から供給される連続する画像情報または音響情報を、内蔵する記録媒体に記録し、前記記録媒体から再生した前記情報を前記情報処理装置に出力し、かつ、シーク、記録または再生の動作に誤りがあった場合、その動作を再実行する記録媒体駆動装置に、

前記情報処理装置が出力する、前記再実行を制御する制御信号を受信する制御信号受信ステップと、

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前記情報処理装置が出力する前記制御信号に基づいて、前記再実行を制御する再実行制御ステップとを含む処理を実行させるコンピュータが読み取り可能なプログラムを提供することを特徴とする提供媒体。

【請求項９】 シーク、記録または再生の動作に誤りがあった場合、その動作を再実行する記録媒体駆動装置が接続され、連続する画像情報または音響情報を、前記記録媒体駆動装置に内蔵される記録媒体に記録または再生させる情報処理装置において、

前記記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の前記再実行による遅延時間を管理する管理手段と、

前記管理手段が管理する前記遅延時間に基づいて、前記記録媒体駆動装置の前記再実行を制御する制御信号を発生する発生手段と、

前記発生手段により発生された前記制御信号を、前記記録媒体駆動装置に送信する送信手段とを備えることを特徴とする情報処理装置。

【請求項１０】 前記管理手段は、前記記録媒体駆動装置が出力する前記再実行による遅延時間に関する情報を受信することを特徴とする請求項９に記載の情報処理装置。

【請求項１１】 前記発生手段は、前記再実行の最大許容回数または最大許容時間を制御する制御信号を発生することを特徴とする請求項９に記載の情報処理装置。

【請求項１２】 前記発生手段は、前記再実行の最大許容時間または最大許容回数を、前記記録媒体駆動装置が、同時に記録または再生を実行する情報のチャンネル数に対応して制御する制御信号を発生することを特徴とする請求項１１に記載の情報処理装置。

【請求項１３】 前記発生手段は、前記再実行の最大許容時間または最大許容回数を制御する制御信号を、シーク、記録または再生の動作を指令する制御信号と共に発生することを特徴とする請求項１１に記載の情報処理装置。

【請求項１４】 シーク、記録または再生の動作に誤りがあった場合、その動作を再実行する記録媒体駆動装置が接続され、連続する画像情報または音響情報を、前記記録媒体駆動装置に内蔵される記録媒体に記録または再生させる情報処理装置の情報処理方法において、

前記記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の前記再実行による遅延時間を管理する管理ステップと、

前記管理ステップで管理する前記遅延時間に基づいて、前記記録媒体駆動装置の前記再実行を制御する制御信号を発生する発生ステップと、

前記発生ステップで発生された前記制御信号を、前記記録媒体駆動装置に送信する送信ステップとを含むことを特徴とする情報処理方法。

【請求項１５】 シーク、記録または再生の動作に誤り

があった場合、その動作を再実行する記録媒体駆動装置が接続され、連続する画像情報または音響情報を、前記記録媒体駆動装置に内蔵される記録媒体に記録または再生させる情報処理装置に、
前記記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の前記再実行による遅延時間を管理する管理ステップと、
前記管理ステップで管理する前記遅延時間に基づいて、前記記録媒体駆動装置の前記再実行を制御する制御信号を発生する発生ステップと、
前記発生ステップで発生された前記制御信号を、前記記録媒体駆動装置に送信する送信ステップとを含む処理を実行させるコンピュータが読み取り可能なプログラムを提供することを特徴とする提供媒体。
【請求項１６】　情報処理装置と、前記情報処理装置に接続され、シーク、記録または再生の動作に誤りがあった場合、その動作を再実行する、前記情報処理装置から供給された連続する画像情報または音響情報を、内蔵する記録媒体に記録すると共に、前記記録媒体から再生した前記情報を前記情報処理装置に出力する記録媒体駆動装置とからなる情報記録再生システムにおいて、
前記記録媒体駆動装置は、
前記情報処理装置が出力する、前記再実行を制御する制御信号を受信する制御信号受信手段と、
前記情報処理装置が出力する前記制御信号に基づいて、前記再実行を制御する再実行制御手段とを備え、
前記情報処理装置は、
前記記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の前記再実行による遅延時間を管理する管理手段と、
前記管理手段が管理する前記遅延時間に基づいて、前記記録媒体駆動装置の前記再実行を制御する前記制御信号を発生する発生手段と、
前記発生手段により発生された前記制御信号を、前記記録媒体駆動装置に送信する送信手段とを備えることを特徴とする情報記録再生システム。
【請求項１７】　情報処理装置と、前記情報処理装置に接続され、シーク、記録または再生の動作に誤りがあった場合、その動作を再実行する、前記情報処理装置から供給された連続する画像情報または音響情報を、内蔵する記録媒体に記録すると共に、前記記録媒体から再生した前記情報を前記情報処理装置に出力する記録媒体駆動装置とからなる情報記録再生システムの情報記録再生方法において、
前記記録媒体駆動装置の情報記録再生方法は、
前記情報処理装置が出力する、前記再実行を制御する制御信号を受信する制御信号受信ステップと、
前記情報処理装置が出力する前記制御信号に基づいて、前記再実行を制御する再実行制御ステップとを含み、
前記情報処理装置の情報記録再生方法は、

前記記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の前記再実行による遅延時間を管理する管理ステップと、
前記管理ステップで管理する前記遅延時間に基づいて、前記記録媒体駆動装置の前記再実行を制御する制御信号を発生する発生ステップと、
前記発生ステップで発生された前記制御信号を、前記記録媒体駆動装置に送信する送信ステップとを含むことを特徴とする情報記録再生方法。
【請求項１８】　情報処理装置と、前記情報処理装置に接続され、シーク、記録または再生の動作に誤りがあった場合、その動作を再実行する、前記情報処理装置から供給された連続する画像情報または音響情報を、内蔵する記録媒体に記録すると共に、前記記録媒体から再生した前記情報を前記情報処理装置に出力する記録媒体駆動装置とからなる情報記録再生システムの、
前記記録媒体駆動装置に、
前記情報処理装置が出力する、前記再実行を制御する制御信号を受信する制御信号受信ステップと、
前記情報処理装置が出力する前記制御信号に基づいて、前記再実行を制御する再実行制御ステップとを含む処理を実行させ、
前記情報処理装置に、
前記記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の前記再実行による遅延時間を管理する管理ステップと、
前記管理ステップで管理する前記遅延時間に基づいて、前記記録媒体駆動装置の前記再実行を制御する制御信号を発生する発生ステップと、
前記発生ステップで発生された前記制御信号を、前記記録媒体駆動装置に送信する送信ステップとを含む処理を実行させるコンピュータが読み取り可能なプログラムを提供することを特徴とする提供媒体。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、記録媒体駆動装置および方法、情報記録再生システムおよび方法、並びに提供媒体に関し、特に、例えば動画像などの実時間連続データを記録または再生する記録媒体駆動装置および方法、情報記録再生システムおよび方法、並びに提供媒体に関する。
【０００２】
【従来の技術】代表的な磁気ディスク装置であるHDD(Hard Disk Drive)は、磁気ヘッド技術や信号処理技術等の進歩により、1990年頃から現在まで、面記録密度が年率60%で向上し続けている。2000年過ぎには、3.5インチ径のディスク１枚に、10GB乃至20GBのデータが記録できるようになると考えられており、複数枚のディスクを持つHDD１台が100GB以上の記録容量を持つようになる。よって、近年実用化された、DV(Digital Video)（転送レー

ト＝29Mbps)やMPEG2(Moving Picture Experts Group Phase-2)（転送レート＝15Mbps）などの高効率デジタル動画像圧縮技術を用いることにより、HDDに複数チャンネルの動画像情報を同時に記録または再生すること、すなわちマルチチャンネル動画像ディスクレコーダの実用化が可能になる。

【０００３】しかし、HDDは、コンピュータの一次記憶装置として発展してきた歴史から、いわゆる離散テキスト型データを、信頼性よく、できるだけ速く、ランダムにアクセスする方向での技術向上がなされてきた。そのため、HDDの動作は時間軸上で離散的である。すなわち、ホストからHDDに供給された記録や再生などの命令は、１つずつ独立した離散的動作として実行され、所定時間以内に記録動作または再生動作が完了することを保証（実時間性の保証）するには、予めHDDの設計段階で、HDDの動作を所定時間以内に記録または再生の動作が完了するよう制限する必要があった。

【０００４】

【発明が解決しようとする課題】この実時間性の確保を阻害する要因の一つに、データ記録／再生の再実行（リトライ）がある。データ記録／再生の再実行（リトライ）とは、データの記録動作または再生動作中に不具合が見つかった場合、同じ動作を再度実行することを意味する。HDDにおけるデータの記録／再生は、通信技術におけるパケットに相当する短いデータセクタ単位（例えば512Byte単位）で行われる。

【０００５】HDDにおいてデータの記録／再生を実行するために、目標データセクタが存在するトラックにヘッドを移動中に、目標セクタが存在するトラックを発見できなかった場合（シークエラーの場合）、当該データセクタに対してヘッド移動が再度実行（シークリトライ）される。シークエラーは、目標データセクタ群（例えば、512Byte単位）の全データが正しく記録／再生されず、誤り訂正符号(ECC)でも訂正できない長大なバーストエラーを引き起こす可能性がある。従って、シークリトライは、行う方が望ましいが、１回のシークリトライには、数ms乃至数10ms程度の時間が必要となるので、実時間性確保が阻害される。

【０００６】また、１つのデータセクタの記録中に、例えばHDDに外部から加わった機械的衝撃等によって、データトラックからヘッドの位置がずれた場合、ヘッドの元のトラックへの復帰と、ディスク回転により当該セクタがヘッド直下に再来することを待って、当該データセクタに対してデータ記録動作が再度実行（ライトリトライ）される。よって、ライトリトライが生じると、本来は連続的なデータ記録動作が一旦途切れ、ディスク回転待ち時間（例えば回転速度が90Hzの場合、11ms）が必要になるので、実時間性が阻害される。

【０００７】更に、１つのデータセクタの再生時にセクタに付加された誤り訂正符号の訂正能力を越えた量のエラーが発生し、訂正不能と判断された場合には、ディスクの回転により当該セクタがヘッド直下に再来することを待って、当該論理セクタの再生動作が再度実行（リードリトライ）される。この場合も、本来は連続的なデータ再生動作が一旦途切れ、ディスク回転待ち時間が必要になるので、実時間性が阻害される。更に１度リードリトライしても、再度訂正不能と判定された場合には、２回目のリードリトライが実行される。エラーがノイズなどのランダムな原因によるハードエラーである場合には、例えば10回以上リードリトライを行っても正しく読めず、100ms以上ものリトライ時間が必要となり、実時間性確保に致命的な傷害となる。

【０００８】上記各種再実行の最大実行回数は、HDDの設計に予め決められる値であって、ディスクレコーダ全体の状況に応じて適切に制御されるものではなかった。また、従来から、リトライの実行を全面的に許可するか、または、禁止する手段（例えば、ANSI(American National Standards Institute)のATA（AT-Attachment）インターフェース規格の一部）は提供されているが、リトライを全面的に許可すれば、無駄時間が増え、実時間が確保できなくなる。逆に、全面的に禁止すれば、シークエラー救済不能によるバーストエラーを引き起こし、画質が大幅に劣化するという課題があった。

【０００９】本発明は、このような状況に鑑みてなされたものであり、各種再実行を実時間性の確保が可能な範囲で実行することにより、HDDとして必要な画質および信頼性を維持しながらも、動画像の連続記録あるいは再生に必要な実時間性が損なわれないようにするものである。

【００１０】

【課題を解決するための手段】請求項１に記載の記録媒体駆動装置は、情報処理装置が出力する、再実行を制御する制御信号を受信する制御信号受信手段と、情報処理装置が出力する制御信号に基づいて、再実行を制御する再実行制御手段とを備えることを特徴とする。

【００１１】請求項７に記載の記録媒体駆動方法は、情報処理装置が出力する、再実行を制御する制御信号を受信する制御信号受信ステップと、情報処理装置が出力する制御信号に基づいて、再実行を制御する再実行制御ステップとを含むことを特徴とする。

【００１２】請求項８に記載の提供媒体は、情報処理装置が出力する、再実行を制御する制御信号を受信する制御信号受信ステップと、情報処理装置が出力する制御信号に基づいて、再実行を制御する再実行制御ステップとを含む処理を実行させるコンピュータが読み取り可能なプログラムを提供することを特徴とする。

【００１３】請求項９に記載の情報処理装置は、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の再実行による遅延時間を管理する管理手段と、管理手段が管理する遅延時間に基づいて、記録媒体

駆動装置の再実行を制御する制御信号を発生する発生手段と、発生手段により発生された制御信号を、記録媒体駆動装置に送信する送信手段とを備えることを特徴とする。

【００１４】請求項１４に記載の情報処理方法は、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の再実行による遅延時間を管理する管理ステップと、管理ステップで管理する遅延時間に基づいて、記録媒体駆動装置の再実行を制御する制御信号を発生する発生ステップと、発生ステップで発生された制御信号を、記録媒体駆動装置に送信する送信ステップとを含むことを特徴とする。

【００１５】請求項１５に記載の提供媒体は、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の再実行による遅延時間を管理する管理ステップと、管理ステップで管理する遅延時間に基づいて、記録媒体駆動装置の再実行を制御する制御信号を発生する発生ステップと、発生ステップで発生された制御信号を、記録媒体駆動装置に送信する送信ステップとを含む処理を実行させるコンピュータが読み取り可能なプログラムを提供することを特徴とする。

【００１６】請求項１６に記載の情報記録再生システムは、記録媒体駆動装置は、情報処理装置が出力する、再実行を制御する制御信号を受信する制御信号受信手段と、情報処理装置が出力する制御信号に基づいて、再実行を制御する再実行制御手段とを備え、情報処理装置は、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の再実行による遅延時間を管理する管理手段と、管理手段が管理する遅延時間に基づいて、記録媒体駆動装置の再実行を制御する制御信号を発生する発生手段と、発生手段により発生された制御信号を、記録媒体駆動装置に送信する送信手段とを備えることを特徴とする。

【００１７】請求項１７に記載の情報記録再生方法は、記録媒体駆動装置の情報記録再生方法は、情報処理装置が出力する、再実行を制御する制御信号を受信する制御信号受信ステップと、情報処理装置が出力する制御信号に基づいて、再実行を制御する再実行制御ステップとを含み、情報処理装置の情報記録再生方法は、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の前記再実行による遅延時間を管理する管理ステップと、管理ステップで管理する遅延時間に基づいて、記録媒体駆動装置の再実行を制御する制御信号を発生する発生ステップと、発生ステップで発生された制御信号を、記録媒体駆動装置に送信する送信ステップとを含むことを特徴とする。

【００１８】請求項１８に記載の提供媒体は、情報処理装置が出力する、再実行を制御する制御信号を受信する制御信号受信ステップと、情報処理装置が出力する制御信号に基づいて、再実行を制御する再実行制御ステップとを含む処理を実行させ、情報処理装置に、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の再実行による遅延時間を管理する管理ステップと、管理ステップで管理する遅延時間に基づいて、記録媒体駆動装置の再実行を制御する制御信号を発生する発生ステップと、発生ステップで発生された制御信号を、記録媒体駆動装置に送信する送信ステップとを含む処理を実行させるコンピュータが読み取り可能なプログラムを提供することを特徴とする。

【００１９】請求項１に記載の記録媒体駆動装置、請求項７に記載の記録媒体駆動方法、および請求項８に記載の提供媒体においては、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合、情報処理装置からの制御信号に基づいて、記録媒体駆動装置の再実行が制御される。

【００２０】請求項９に記載の情報処理装置、請求項１４に記載の情報処理方法、および請求項１５に記載の提供媒体においては、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合、情報処理装置によって、記録媒体駆動装置の再実行による遅延時間が管理される。

【００２１】請求項１６に記載の情報記録再生システム、請求項１７に記載の情報記録再生方法、および請求項１８に記載の提供媒体においては、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合、情報処理装置によって、記録駆動媒体の再実行による遅延時間が管理され、再実行が制御される。

【００２２】

【発明の実施の形態】以下に本発明の実施の形態を説明するが、特許請求の範囲に記載の発明の各手段と以下の実施の形態との対応関係を明らかにするために、各手段の後の括弧内に、対応する実施の形態（但し一例）を付加して本発明の特徴を記述すると、次のようになる。但し勿論この記載は、各手段を記載したものに限定することを意味するものではない。

【００２３】請求項１に記載の記録媒体駆動装置は、情報処理装置（例えば、図１のホスト１）が出力する、再実行を制御する制御信号を受信する制御信号受信手段（例えば、図１のHDC３１）と、情報処理装置が出力する制御信号に基づいて、再実行を制御する再実行制御手段（例えば、図１のCPU３８）とを備えることを特徴とする。

【００２４】請求項２に記載の記録媒体駆動装置は、再実行による遅延時間を前記情報処理装置に送信する遅延時間送信手段（例えば、図１９のステップＳ５１）をさらに備えることを特徴とする。

【００２５】請求項９に記載の情報処理装置は、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の再実行による遅延時間を管理する管理手段（例えば、図１０のステップＳ２１）と、管理手段が管

理する遅延時間に基づいて、記録媒体駆動装置の再実行を制御する制御信号を発生する発生手段（例えば、図１０のステップＳ２２）と、発生手段により発生された制御信号を、記録媒体駆動装置に送信する送信手段（例えば、図１のメモリ制御回路１５）とを備えることを特徴とする。

【００２６】請求項１６に記載の情報記録再生システムは、記録媒体駆動装置が、情報処理装置が出力する、再実行を制御する制御信号を受信する制御信号受信手段（例えば、図１のHDC３１）と、情報処理装置が出力する制御信号に基づいて、再実行を制御する再実行制御手段（例えば、図１のCPU３８）とを備え、情報処理装置が、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合の再実行による遅延時間を管理する管理手段（例えば、図１０のステップＳ２１）と、管理手段が管理する遅延時間に基づいて、記録媒体駆動装置の再実行を制御する制御信号を発生する発生手段（例えば、図１０のステップＳ２２）と、発生手段により発生された制御信号を、記録媒体駆動装置に送信する送信手段（例えば、図１のメモリ制御回路１５）とを備えることを特徴とする。

【００２７】以下に、本発明を適用した情報記録再生システムについて説明する。なお、以下の例では、典型的な例として、固定型HDDについて説明する。

【００２８】図１には、本発明を適用した情報記録再生システムとしてのデジタル画像ディスクレコーダの構成例が表されている。ホスト１には、ホストインターフェースバス２を介してHDD３が接続させている。ホスト１の第１のチャンネル（Ch.1）のAV(Audio Visual)エンコーダ１１－１は、入力された画像信号を、例えば、MPEG方式で圧縮（エンコード）する画像情報圧縮器１２、画像信号に対応する音響信号をMPEG方式で圧縮（エンコード）する音響情報圧縮器１３、並びに画像情報圧縮器１２と音響情報圧縮器１３の出力を合成するマルチプレクサ（MUX）１４とを有している。第１のチャンネルのAVエンコーダ１１－１と同様に、第２のチャンネル（Ch.2）のAVエンコーダ１１－２が設けられており、図示は省略するが、このAVエンコーダ１１－２も、第２のチャンネルの画像信号を圧縮する画像情報圧縮器、第２のチャンネルの音響信号を圧縮する音響情報圧縮器、およびそれらの圧縮信号をマルチプレクスするマルチプレクサを内蔵している。

【００２９】AVエンコーダ１１－１または、AVエンコーダ１１－２より出力された信号は、メモリ制御回路１５に入力される。メモリ制御回路１５にはまた、既に、図示せぬ装置で圧縮されている第３のチャンネル（Ch.3）の圧縮映像音響データも入力される。

【００３０】メモリ制御回路１５には、ホストメモリ２２が接続されており、このホストメモリ２２には、HDD３としての磁気ディスク４５（以下、単に、ディスク４５と称する）に記録または再生される単位としての１クラスタ分のデータが、少なくとも記憶される。メモリ制御回路１５は、AVエンコーダ１１－１，１１－２より入力される圧縮映像音響データ、または、既に圧縮された状態で入力される圧縮映像音響データをホストメモリ２２に供給し、記憶させた後、AV－インタフェース（I/F）２７からホストインタフェースバス２を介してHDD3に供給する。また、メモリ制御回路１５は、HDD３からホストインタフェースバス２、およびAVインタフェース２７を介して入力された再生データを、ホストメモリ２２に一旦記憶させた後、適宜それを読み出し、AVデコーダ１６－１，１６－２に出力するか、または、そのまま図示せぬ装置に出力する。

【００３１】第１のチャンネルのAVデコーダ１６－１は、メモリ制御回路１５より入力された圧縮映像音響データから、映像データと音響データを分離し、それぞれ、補間回路１８と補間回路２０に出力するデマルチプレクサ（DEMUX）１７を有している。補間回路１８は、デマルチプレクサ１７より入力された圧縮映像データの誤りを補間し、画像情報伸長器１９に出力している。画像情報伸長器１９は、画像情報圧縮器１２に対応する伸長処理を行い、伸長した画像信号を、図示せぬ装置に出力する。補間回路２０は、デマルチプレクサ１７より入力された音響データの誤りを補間し、音響情報伸長器２１に出力している。音響情報伸長器２１は、音響情報圧縮器１３に対応する方式で入力された音響情報を伸長し、図示せぬ装置に出力する。

【００３２】図示は省略するが、AVデコーダ１６－２も、AVデコーダ１６－１と同様に、デマルチプレクサ、補間回路、画像情報伸長器、および音響情報伸長器を内蔵している。

【００３３】この例では、１台のHDD４０をホストインタフェースバス２を介して、ホスト１と接続し、同時に３チャンネルの圧縮動画・音響データが記録または再生できる構成となっている。ホストインタフェースバス２としては、例えばANSI（American National Standards Institute）における拡張IDE（Integrated Device Electronics）規格（ATA（AT Attachment）規格）が用いられる。ディスクレコーダ全体の動作は、CPU２４により管理されており、そのファームウエアはROM２６に記憶されており、RAM２５はCPU２４の作業領域として用いられる。ユーザからディスクレコーダへ動作指示を与え、またディスクレコーダからユーザに動作状況を知らせるためのユーザインタフェース機構として、特に図示しないスイッチ、リモートコントローラ、キーボード、液晶表示装置等が装備され、それらとの入出力はCPU２４が管理する。

【００３４】HDD３に対する記録または再生の指示は、CPU２４がCPUバス２３を介してAV-I/F２７から拡張IDE規格に定義されているWrite命令またはRead命令を発行さ

せることにより行われる。また、ホスト１とHDD3の間のデータの転送は、CPU2４がメモリ制御回路１５とAV-I/F2７に指示することにより実行される。

【００３５】HDD3は、ハードディスクコントローラ（HDC）３１を有しており、HDC３１は、ホストインタフェースバス２を介して入力されたデータを、一旦バッファメモリ３２に記憶させた後、適宜これを読み出して、記録チャンネル信号処理回路３３に供給するとともに、再生チャンネル信号処理回路３７より供給された再生データを、バッファメモリ３２に一旦記憶させた後、適宜これを読み出して、ホストインタフェースバス２を介して出力する。

【００３６】記録チャンネル信号処理回路３３は、入力されたデータを所定の変調方式で変調した後、増幅器３４を介して磁気ヘッド（以下、単に、ヘッドと称する）３５に供給し、ディスク４５に記録させる。

【００３７】また、ヘッド３５は、ディスク４５に記録されているデータを再生し、増幅器３６を介して再生チャンネル信号処理回路３７に出力する。再生チャンネル信号処理回路３７は、入力されたデータを記録チャンネル信号処理回路３３における場合と対応する方式で復調し、HDC３１に出力する。

【００３８】CPU３８は、CPUバス３９を介して、HDC３１や再生チャンネル信号処理回路３７、記録チャンネル信号処理回路３３などを制御するようになされている。サーボDSP（デジタルシグナルプロセッサ）４０は、再生チャンネル信号処理回路３７より入力された再生データに基づいてサーボ信号を生成し、増幅器４１を介して、ボイスコイルモータ（VCM）４２に出力する。VCM4２は、入力された信号に対応してヘッド３５をディスク４５の半径方向に移送（シーク）し、ヘッド３５をディスク４５の所定のトラック上に位置させる。

【００３９】スピンドルモータ（SPM）制御器４３は、スピンドルモータ（SPM）４４が出力するFG信号とPG信号に基づいて制御信号を生成して、スピンドルモータ４４を所定の速度で回転させる。

【００４０】図２に、ROM2６に格納され、CPU2４が実行するファームウエアの階層構成を示す。下位の第１層には、前記ユーザインタフェース機構との入出力を行うユーザI/F部、MPEG2エンコーダ・デコーダ管理部、メモリ制御回路１５に指示して、ホストメモリ２２へのAVデータストリームやクラスタの書き込みや読み出しを行うホストメモリ管理部、およびHDDデバイスドライバが設けられている。上位の第２層には、これら第１層を管理し、ディスクレコーダ全体の動作を司るシステム管理ソフトウエアが設けられている。システム管理ソフトウエアの機能には、各チャンネルの記録や再生動作の指示と管理、HDD3やホストメモリ２２などの各ハードウエア資源の稼働状況の把握と管理など、デジタル動画ディスクレコーダに必要な機能のうち、第１層に含まれていない全てのものが含まれる。

【００４１】まず、デジタル動画ディスクレコーダ全体における記録時の信号の流れを説明する。第１のチャンネル（Ch.1）においては、外部から入力されたアナログ画像信号（例えばNTSC信号）が、画像情報圧縮器１２においてデジタル化された後、データレートが１／５程度まで圧縮される。画像情報圧縮の方式としては、DVやMPEG2などが実用化されており、元のデジタル映像情報に対して、離散コサイン変換やフレーム間動き検出、再量子化、２次元ハフマン符号化などを行うことにより、情報量が圧縮される。外部から同時に入力されたアナログ音響信号も、音響情報圧縮器１３によりデジタル化され、データレートが圧縮される。圧縮された映像情報と音響情報は、MUX１４でマルチプレクスされ、AVデータストリームとされる。いまの場合、映像情報圧縮方式としてMPEG2方式を用い、AVデータストリームのデータレートは8Mbit/sであるとする。

【００４２】このAVデータストリームは、メモリ制御回路１５を介して、一旦ホストメモリ２２に順次記憶される。CPU2４はファームウエアのホストメモリ管理部に従って、メモリ制御回路１５に指示を出し、ホストメモリ２２からHDD3に記録すべきひとまとまりのデータであるクラスタを読み出し、AV-I/F2７を介してホストインタフェースバス２を経て、HDD3に送り、記録させる。

【００４３】図３に、クラスタと、MPEG2のデータストリームに定義されるGOP（Group of picture）の関係を示す。図３の例では、クラスタは、GOPを４分割して得たデータのまとまりとされている。GOPは15フレームの画像よりなり、１フレームは1/30秒に相当するので、１つのGOPは0.5秒に相当し、ビットレートが、８Mbit/sとすると、そのデータ量は4Mbitとなる。よって、それを４分割して得た１つのクラスタのデータ量は1Mbitであり、HDD3のセクタサイズが512Byte（4096bit）なので、約256セクタ分のデータ量に相当する。すなわち、HDD3は、ホスト１から記録命令を受ける度に、約256セクタにAVデータストリームを連続的に記録する。

【００４４】記録時のHDD3の動作は以下に述べる通りである。簡単のため、図４に示すように、Ch.1の１本のデータストリームのみを記録する場合を例にあげる。

【００４５】CPU2４は、記録すべき１つのクラスタが、HDD3の所定の論理ブロックアドレスから所定の長さのデータブロックとして連続して記録されるように、HDD3にコマンドを送る。HDD3の内部のHDC３１は、このコマンドを受け、CPU3８と共同して、論理ブロックアドレスを、HDD3の内部の物理アドレス（ディスク面番号、トラック番号、セクタ番号等）に変換する。続いて、ホストメモリ２２から送出された１クラスタ分のデータ（例えば256セクタ分のデータ）が、ホストインタフェースバス２を介してHDC３１に受け取られ、バッフ

ァメモリ３２に一旦蓄積される。

【００４６】HDC３１は、このデータをHDD3のトラック上に設定された論理データセクタの長さ（512Byte）に分割し、さらにその前後に、読み出し時にビット同期を取るためのプリアンブルパターンや誤り訂正符号を付加してセクタデータを形成した後、ディスク回転に同期しながら、記録チャンネル信号処理回路３３に出力する。記録チャンネル信号処理回路３３は、そのセクタデータにチャンネル符号化を施し、ヘッド３５とディスク４５からなる磁気記録チャンネルの特性に適合した２値系列に変換する。この２値系列は、増幅器３４により、矩形状の記録電流波形に対応付けられ、ヘッド３５によって、磁気ディスク４５上の磁化反転パターンとして記録される。

【００４７】ここで、予め記録対象となる目標トラックにヘッド３５を位置決めしておく必要があるので、HDC３１とCPU３８から目標トラック番号を受け取ったサーボDSP４０は、ディスク面上のトラック番号を再生チャンネル信号処理回路３７から受け取りながら、ヘッド３５をその物理アドレスに移動させ、位置決めを行う。以上の例では、図４に示すように、１つのクラスタの記録に使用可能な時間は125msであるが、HDD3のシークと回転待ち動作（S1）と記録動作（W1）に要する時間は、HDDの速度性能にもよるが、30ms程度であり、残りの時間が余り時間（E）となる。

【００４８】次に、再生時の信号の流れを説明する。

【００４９】まず、システム管理ソフトウエアは、ファームウエアのユーザI/F部からの入力情報に従って、再生すべきAVデータストリーム名を特定し、そのストリームを構成する各クラスタが記録されているHDDの論理ブロックアドレスを求め、HDDデバイスドライバに、ホストインタフェースバス２（例えばIDE-I/F）上に定義された読み出し命令を発行させ、当該クラスタを読み出させる。同時に、ホストメモリ管理部は、メモリ制御回路１５を通じて、ホストメモリ２２に、クラスタを再構成するための記憶領域を確保させる。

【００５０】上記のIDE-I/F上に発行された読み出し命令は、HDD3のHDC３１を介してCPU３８に与えられる。CPU３８は、当該クラスタの論理ブロックアドレスを、ディスク４５の物理アドレス（ディスク面番号、トラック番号、セクタ番号等）に変換し、サーボDSP４０に命じてヘッド３５をその物理アドレスに移動させ、データの読み出しを開始させる。すなわち、ディスク４５上に記録された磁化反転パターンは、ヘッド３５により読み出され、増幅器３６で増幅された後、再生チャンネル信号処理回路３７によりビット同期が取られ、２値データ系列として検出され、記録時に施されたチャンネル符号化の逆変換としての復号化が行われ、セクタデータとして再生される。

【００５１】このセクタデータはHDC３１に送られ、誤り訂正復号化を経て、512バイト単位の論理データとして、バッファメモリ３２に順次蓄積された後、ホストインタフェースバス２とメモリ制御回路１５を介して、ホストメモリ２２に順次転送され、１つのクラスタが形成される。１つのクラスタの読み出しが完了すると、同様に、後続するクラスタの読み出しが命令され、HDD3よりセクタデータ群が読み出され、ホストメモリ２２上に後続クラスタが形成される。形成されたクラスタは、順次読み出され、AVデータストリームとして、例えばCh.1用のAVデコーダ１６－１に与えられる。

【００５２】このAVデータストリームは、デマルチプレクサ１７により映像データと音響データに分離される。映像データは、データにエラーが存在した場合に、前後のデータから補間する補間回路１８を経て画像情報伸長器１９により、通常のデジタル画像情報に伸長される。この画像情報は、D/A変換器などによりNTSCアナログ映像信号に変換され、外部のモニタなどに与えられる。

【００５３】以上、Ch.1のみについて、圧縮画像データを記録する場合と、再生する場合の信号の流れを説明したが、第２のチャンネル（Ch.2）や第３のチャンネル（Ch.3）のデータを含め、複数のデータストリームを記録または再生する場合は、以下のようになる。

【００５４】図５に、Ch.1のデータストリームを記録すると同時に、Ch.2のデータストリームの再生を行う場合のタイミングチャートの例を示す。HDD3には、一度に１つのクラスタしか記録または再生できない。よって、これら２チャンネル分のクラスタを処理する場合、記録または再生が交互に行われる。例えば、まずCh.1のクラスタ(k,1)を記録すべき領域にアクセスするため、シークと回転待ち(S1)を行い、クラスタ(k,1)を記録(W1)する。次に、空き時間(E)をはさんで、Ch.2のクラスタを再生するためシークと回転待ち(S2)を行う。このシーク動作は、これら異なるチャンネルのクラスタが、ディスク面上で全く異なる半径のトラックに存在する場合が普通であるために必要となる。次にクラスタ(k,1)を再生(R2)する。その後、これら一連の動作が繰り返される。図５の例では、１台のHDD3に２チャンネルを同時に記録／再生させても、余裕時間（E）が残る。

【００５５】図６は、３チャンネル（Ch.1, Ch.2, Ch.3）を同時に記録する場合のタイミングチャートの例を示す。ホスト１側からは、Ch.1用AVエンコーダ１１－１が生成するデータストリームと、Ch.2用エンコーダ１１－２が生成するデータストリームと、Ch.3の入力のデータストリームの３本が、メモリ制御回路１５を経てホストメモリ２２に一旦記憶される。それら３本のデータストリームは、それぞれクラスタに分割され、交互に、ホストインタフェースバス２上のWrite命令によって、HDD3に記録される。HDD3は、上記図５の２チャンネル同時動作の場合と同様に、一度には１チャンネルのクラスタのみを記録し、交互に３チャンネルの記録を進めて行

く。

【００５６】この場合は、図６に示すように、HDD3は、シークと記録の動作で忙しく、空き時間(E)は非常に短くなる。このようにディスクレコーダが、HDD3の速度性能が許す最大のチャンネル数において、同時に記録または再生する場合には、長時間の空き時間を確保することは難しい。

【００５７】以上のディスクレコーダの動作説明から判るように、HDD3の動作状況は、その時点でディスクレコーダが扱っているチャンネル数に依存して変化する。すなわち、最大３チャンネル同時記録／再生が可能なレコーダの例では、３チャンネル同時動作をしている時には、HDD3はわずかな空き時間しか持たないものの、１チャンネル動作の場合には、かなりの空き時間が存在する。また、実際の使用状況では、ディスクレコーダが最大可能チャンネル数で、常時動作し続けることは無く、必ず動作チャンネル数が少なくなる、または全く記録／再生しない休止状態になる場合が存在する。ディスクレコーダのシステム管理ソフトウエアは、動作チャンネル数など、ディスクレコーダの動作状況を把握しているので、HDD3の空き時間の状況も把握できる。

【００５８】そこで、本発明では、ディスクレコーダにおいて、HDD3に空き時間または休止時間が存在し、かつホスト１側のシステム管理ソフトウエアが空き時間の状況を把握していることに着目し、それら空き時間または休止時間において、HDD3が従来の技術の項で述べたシークリトライ、ライトリトライ、およびリードリトライを、可能な限り実行できるように、ホスト１が制御する。

【００５９】このため、ホストインタフェースバス２上において、シークリトライ、ライトリトライ、およびリードリトライ動作に対し、ホスト１が実行を指示するコマンドが設けられている。これらのコマンドにより、シークリトライ、ライトリトライ、およびリードリトライ動作の実行に関して、ホスト１とHDD3が通信することが可能になり、HDD3の信頼性の維持管理のために必要なシークリトライ、ライトリトライ、およびリードリトライ動作が、ディスクレコーダの動作状況が許す限り、ホスト１の管理下で実行できるようになる。

【００６０】以下に、上述したシークリトライ、ライトリトライ、およびリードリトライ動作について、ホスト１が実行を管理する場合の処理例を述べる。

【００６１】まず、再生されたデータに誤りが存在したときの再読み出しの許容回数を、ホスト１から指示する場合の第１の動作例について述べる。

【００６２】図７は、このために、新たに設定されるAVモード設定コマンド１２０の構成を表しており、このコマンド１２０は、AVストリームデータの書き込み、読み出しにおける動作モードを設定するコマンドである。AVモード設定動作を指定するコマンド識別コード（例えば８５ｈ）がCommandレジスタ１０６に指定されている。コマンド１２０のデータ（パラメータ）としてホスト１のCPU２４からHDD3に送られるデータ（パラメータ）１２１は、図８に示すように構成され、ここには、AVストリームデータの読み出し、書き込み、およびシーク時における動作モードを規定するいろいろなパラメータが含まれている。このデータ１２１の中に、再生時および記録時において、１つのコマンドに対して許容されるリトライ回数が指定される。例えば図８の例においては、データ１２１のバイト０にリードリトライ許容回数が、データ１２１のバイト１にライトリトライ許容回数が、データ１２１のバイト２にシークリトライ許容回数が、それぞれ指定されている。なお、図８においては、その他のパラメータは図示が省略されている。

【００６３】HDD3内のHDC３１ならびにCPU３８は、当該コマンド１２０とパラメータ１２１を受信したとき、リトライ回数の設定動作を、図９に示すフローチャートに従って次のように行う。動作パラメータ１２１にはリトライ回数以外にもAVモード動作時のパラメータが含まれているが、図９においても、これらの処理は示されていない。

【００６４】CPU３８は、内部のRAM領域の中に記憶している、シーク、リード、およびライトに関するリトライ最大回数の変数の値を、コマンド１２０のパラメータ１２１によって指示される値に変更する（ステップＳ１１）。これ以降CPU３８は、当該変数の値をシーク、リード、およびライト時のリトライ許容回数の値として、ライト、またはリードコマンドを実行する。

【００６５】以上のような処理を行うことで、ホスト１から１コマンドあたりのリトライ許容回数を指定することにより、コマンド当たりの実行時間の増加をホスト１が制御することができる。

【００６６】ホスト１のCPU２４は、以上のように定義されたAVモード設定コマンド１２０を用いて、HDD3との間でAVストリームデータの転送を行う場合、図１０に示すフローチャートに従って次のように処理を進める。

【００６７】ホスト１のCPU２４は、現在のチャンネル数、空き時間、クラスタサイズ等を考慮して、所定時間内に所定のチャンネル数のデータを記録再生するためのリトライ回数を決定する（ステップＳ２１）。例えば、図４の例においては、１チャンネルのみの記録であるから、０．１２５秒の間に２５６セクタのデータを書けばよく、空き時間Eが多いので、リトライ回数を空き時間Eを超えない範囲で増加させることができる。また、図６の例は３チャンネルの同時記録の場合であり、明らかに図４の場合よりも空き時間Eが少ない。このような場合には、CPU２４は、リトライ回数を少なくするという判断を行うことになる。

【００６８】次に、ホスト１のCPU２４は、コマンド１２０を発行して、HDD3に対し、最大リトライ回数を設

定する（ステップＳ２２）。CPU２４は、記録再生チャンネル数、空き時間、クラスタサイズなどの実行環境の変更が生ずるたびにステップＳ２１，Ｓ２２の処理を繰り返し、最適なリトライ回数の設定を行う（ステップＳ２３）。

【００６９】再生されたデータに誤りが存在したときの再読み出しの許容回数を、ホスト１から指示する場合の、第２の動作例について以下に述べる。

【００７０】図１１は、このために新たに定義されるAVストリームリードコマンド１２２の構成を表している。リードコマンドを実行してAVストリームデータ転送を行うとき、例えばFeatureレジスタ１００を用いてそのコマンドだけに有効なリトライ回数の許容値が指定される。コマンド１２２においては、ATA標準のリードコマンドと同様に、そのSector Countレジスタ１０１に、読み出しセクタ数が、Sector Numberレジスタ１０２、Cylinder Lowレジスタ１０３、Cylinder Highレジスタ１０４、並びにDevice/Headレジスタ１０５の下位４ビットに、読み出し開始論理ブロックアドレスが指定される。コマンド１２２では、AVストリームデータリード処理を示すコマンド識別コード（例えば８６ｈ）がCommandレジスタ１０６に指定される。

【００７１】HDD3内のHDC３１ならびにCPU３８は、当該コマンド１２２を受信したとき、AVストリームデータの読み出しを、図１２に示すフローチャートに従って次のように行う。

【００７２】CPU３８は、内部のRAM領域の中で記憶している、リードのリトライ最大回数の変数の値を、一時的に別の領域に待避する（ステップＳ３１）。そして、コマンド１２２で指定されたディスク４５上の領域を、次のステップＳ３３でアクセスする間、リードのリトライ最大回数を記憶している変数の値を、コマンド１２２のFeaturesレジスタ１００で指定されたリトライ許容回数の値に変更し（ステップＳ３２）、読み出し処理を実行する（ステップＳ３３）。読み出し処理が終了したら、ステップＳ３１で一時的に待避したリトライ最大回数の値を元に戻す（ステップＳ３４）。

【００７３】以上のような処理を行うことで、ホスト１からコマンド毎にリトライ許容回数を指定することにより、ホスト１のCPU２４がコマンド実行時間をより細かく制御することが可能となる。図７のコマンド１２０を使用せずに、効率的に一時的なリトライ回数変更が可能となる。

【００７４】ホスト１のCPU２４は、以上のように定義されたAVストリームリードコマンド１２２を用いて、HDD3との間でAVストリームデータの転送を行う場合は、図１３に示すフローチャートに従って次のように処理を進める。

【００７５】ホスト１のCPU２４は、第１の動作例と同様に、現在のチャンネル数、空き時間、クラスタサイズ等を考慮して、所定時間内（例えば図６の例では０．１２５秒）に所定のチャンネル数のデータを記録再生するためのリトライ回数を決定し、コマンド１２０を発行する（ステップＳ４１）。コマンド１２１において、すべてのコマンドでリトライが発生する最悪の場合を想定して、リトライ回数を指定してコマンド１２０を発行した場合、実際にはリトライが発生しなかったとすると、所定時間の終わりに近づくに従って空き時間が増加する。そこで、空き時間が変化したか否かが判定され（ステップＳ４２）、変化した場合、当該所定時間の終わりに発行されるAVストリームデータリードコマンド１２２では、一時的にリトライ回数を増やしてリードエラーの発生確率を低下させることができる（ステップＳ４３）。空き時間に変化がない場合（ステップＳ４２）、リトライ回数を変えずにコマンド１２２が発行される（ステップＳ４４）。

【００７６】図１４は、新たに定義されるAVストリームライトコマンド１２３の構成を表している。ライトコマンドを実行してAVストリームデータ転送を行うときに、例えばFeatureレジスタ１００を用いてそのコマンドだけに有効なリトライ回数の許容値が指定される。コマンド１２３においても、ATA標準のライトコマンドと同様に、そのSector Countレジスタ１０１に、記録セクタ数が、Sector Numberレジスタ１０２、Cylinder Lowレジスタ１０３、Cylinder Highレジスタ１０４、並びにDevice/Headレジスタ１０５の下位４ビットに、記録開始論理ブロックアドレスが指定される。コマンド１２３では、AVストリームデータライト処理を示すコマンド識別コード（例えば８７ｈ）がCommandレジスタ１０６に指定される。

【００７７】HDD3内のHDC３１ならびにCPU３８は、当該コマンド１２３を受信したとき、AVストリームデータの記録を、コマンド１２２における場合と同様に処理する。

【００７８】更に、図１５の例は、新たにシークリトライ許容回数も指定されるAVストリームリードコマンド１２４の構成を表している。リードコマンドを実行してAVストリームデータ転送を行うときに、例えばコマンド１２２では、Featureレジスタ１００を用いてそのコマンドだけに有効なリードリトライ回数の許容値のみが指定されていたが、コマンド１２４においては、Featureレジスタ１００の上位４ビットにリードリトライ許容回数が指定され、下位４ビットにシークリトライ回数の許容値が割り当てられている。また、コマンド１２４では、AVストリームデータリード処理を示すコマンド識別コード（例えば８８ｈ）がCommandレジスタ１０６に指定される。

【００７９】リードエラーは、前後のデータから補間することにより、救済をはかることがある程度可能である。しかし、これに対して、シークエラーは、目標セク

タデータ群の全データが、正しく読み出されないために長大なバーストエラーを引き起こす可能性がある。従って、リードリトライ回数の許容値よりもシークリトライ回数の許容値をより大きく確保することによって、ディスクレコーダのリードコマンドの信頼性は向上する。よって、CPU２４は、常にシークリトライ回数の許容値をリードリトライ回数の許容値よりも大きくするように制御する。

【００８０】HDD3内のHDC３１ならびにCPU３８は、当該コマンド１２４を受信したとき、AVストリームデータの記録を、コマンド１２２における場合と同様に処理する。

【００８１】図１６の例は、新たにシークリトライ許容回数も指定されるAVストリームライトコマンド１２５の構成を表している。ここでは、コマンド１２４と同様に、Featureレジスタ１００の上位４ビットにリードリトライ許容回数が指定され、下位４ビットにシークリトライ回数の許容値が割り当てられている。また、コマンド１２５では、AVストリームデータリード処理を示すコマンド識別コード（例えば８９ｈ）がCommandレジスタ１０６に指定される。このようにシークリトライ回数の許容値を指定することで、コマンド１２４同様に、ディスクレコーダのライトコマンドの信頼性は向上する。

【００８２】HDD3内のHDC３１ならびにCPU３８は、当該コマンド１２５を受信したとき、AVストリームデータの記録を、コマンド１２２における場合と同様に処理する。

【００８３】次に、再生されたデータに誤りが存在したときの再読み出しの許容回数を、ホスト１から指示する場合の、第３の動作例について述べる。

【００８４】第３の例においても、第１および第２の動作例と同様に、AVモード設定コマンド１２０およびデータ１２１を用いてリトライ回数が指定され、コマンド１２２を用いてコマンド毎に一時的にリトライ回数が変更される。第３の動作例では、これらに加えて、図１７に示す、リトライステータスセンスコマンド１２６が新たに定義される。コマンド１２６では、リトライステータスセンスコマンド処理を示すコマンド識別コード（例えば９０ｈ）がCommandレジスタ１０６に指定される。コマンド１２６は、直前のリード、ライトコマンドにおいて、データやシークのリトライが原因で発生した遅延時間がどのくらい発生したかを、図１８に示すステータス情報１２７として報告する。ステータス情報１２７の中には、リトライによる遅延時間情報として、例えばシークリトライによる遅延、データリトライによる遅延量が、秒単位、または、ディスク４５の１周回時間単位で記述される。

【００８５】HDD3内のHDC３１ならびにCPU３８は、当該コマンド１２６を受信したとき、直前に実行したリード、或いはライトコマンドでリトライが原因で生じた遅延情報の報告を、図１９に示すフローチャートに従って次のように進める。

【００８６】CPU３８は、リード、ライトコマンド処理においてコマンドの実行中（例えば、図１３の例ではステップＳ４３またはＳ４４）に発生した遅延時間を計測し、内蔵するメモリに記憶する。CPU３８は、コマンド１２６を受信すると、当該遅延時間をステータス情報１２７としてホスト１のCPU２４へ通知する（ステップＳ５１）。以上のような処理を行うことで、ホスト１からコマンド１２６を発行することによって、ホスト１のCPU２４は、実際に発生したリトライによる遅延時間情報を把握することができ、以降のコマンドにおけるリトライ許容回数をきめ細かく制御することが可能となる。

【００８７】ホスト１のCPU２４が、以上のように定義されたAV用リード、ライトコマンド１２６を用いて、HDD3との間でAVストリームデータの転送を行う場合は、図２０に示すフローチャートに従って次のように処理を進める。

【００８８】ホスト１のCPU２４は、第１と第２の動作例と同様に、現在のチャンネル数、空き時間、クラスタサイズ等を考慮して、所定時間内（例えば図４の例では０．１２５秒）に所定のチャンネル数のデータを記録再生するためのリトライ回数を決定し、コマンド１２０を発行して、最大リトライ回数を設定する（ステップＳ６１）。次にCPU２４は、コマンド１２２を発行して、データの読み出しを行い（ステップＳ６２）、引き続いて、コマンド１２６を発行して、当該コマンド１２２の実行中に生じた遅延情報を入手する（ステップＳ６３）。HDD3からコマンド１２６に対応するステータス情報１２７を入手したとき、遅延情報に基き、空き時間が再計算される（ステップＳ６４）。ここで再計算された空き時間は、次のコマンド１２２を発行する際にリトライ回数の決定時に参照される。

【００８９】尚、以上の３つの実施の形態においては、リトライの制限方法として、各リトライの最大許容回数を設定するとして説明したが、第２の制限方法として、各リトライの最大許容時間を設定するとしても良い。

【００９０】以上においては、記録媒体として磁気ディスク（ハードディスク）を例として説明したが、本発明は磁気ディスク以外の、光ディスク、光磁気ディスクなどの記録媒体に対しても適用することが可能である。

【００９１】また、ディスクが交換可能なリムーバブルHDD、またはその他の磁気ディスク装置においても本発明は、適用することができることは言うまでもない。

【００９２】なお、本明細書において、システムとは、複数の装置で構成される全体的な装置を示すものとする。

【００９３】また、上記したような処理を行うコンピュータプログラムをユーザに提供する提供媒体としては、磁気ディスク、CD-ROM、固体メモリなどの記録媒体の

他、ネットワーク、衛星などの通信媒体を利用することができる。

【００９４】

【発明の効果】請求項１に記載の記録媒体駆動装置、請求項７に記載の記録媒体駆動方法、および請求項８に記載の提供媒体によれば、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合、情報処理装置からの制御信号に基づいて、記録媒体駆動装置の再実行が制御されるので、実時間性と信頼性が保証された記録媒体駆動装置を実現することができる。

【００９５】請求項９に記載の情報処理装置、請求項１４に記載の情報処理方法、および請求項１５に記載の提供媒体によれば、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合、情報処理装置によって、記録媒体駆動装置の再実行による遅延時間が管理されるので、実時間性と信頼性を確保できる。

【００９６】請求項１６に記載の情報記録再生システム、請求項１７に記載の情報記録再生方法、および請求項１８に記載の提供媒体によれば、記録媒体駆動装置のシーク、記録または再生の動作に誤りがあった場合、情報処理装置によって、記録駆動媒体の再実行による遅延時間が管理され、再実行が制御されるので、実時間性と信頼性を確保したシステムを実現することができる。

【図面の簡単な説明】

【図１】本発明を適用したデジタル画像ディスクレコーダの構成を示すブロック図である。

【図２】図１のホスト１側のCPU２４のソフトウェアの構成例を示すブロック図である。

【図３】記録／再生のデータ単位であるクラスタと、MPEG2におけるGOPの関係を示す図である。

【図４】１本のAVデータストリームを記録する場合のHDDの動作を示すタイミングチャートである。

【図５】複数のAVデータストリームを同時に記録／再生する場合のHDDの動作を示すタイミングチャートである。

【図６】３本のAVデータストリームを同時に記録／再生する場合のHDDの動作を示すタイミングチャートである。

【図７】AVモード設定コマンドのフォーマットを示す図である。

【図８】AVモード設定パラメータのフォーマットを示す図である。

【図９】図１のHDD３のAVモード設定コマンド処理を説明するフローチャートである。

【図１０】図１のホスト１のAVモード設定コマンド処理を説明するフローチャートである。

【図１１】AVストリームリードコマンドのフォーマットを示す図である。

【図１２】図１のHDD３のAVストリームリードコマンド処理を説明するフローチャートである。

【図１３】図１のホスト１のリトライ回数指定処理を説明するフローチャートである。

【図１４】AVストリームライトコマンドのフォーマットを示す図である。

【図１５】AVストリームリードコマンド（シークリトライ許容回数指定）のフォーマットを示す図である。

【図１６】AVストリームライトコマンド（シークリトライ許容回数指定）のフォーマットを示す図である。

【図１７】リトライステータスセンスコマンドのフォーマットを示す図である。

【図１８】リトライステータス情報のフォーマットを示す図である。

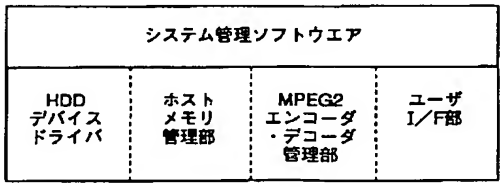
【図１９】図１のHDD３のリトライステータスセンスコマンド処理を説明するフローチャートである。

【図２０】図１のホスト１のリトライ回数指定処理を説明するフローチャートである。

【符号の説明】

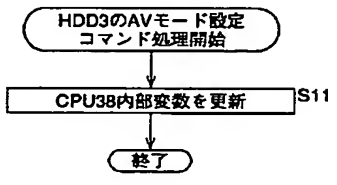
１　ホスト，　３　ハードディスクドライブ，　１１－１，１１－２　AVエンコーダ，　１６－１，１６－２　AVデコーダ，　２４　CPU，　３１　ハードディスクコントローラ，　３２　バッファメモリ，　３３　記録チャンネル信号処理回路，　３５　ヘッド，　３７　再生チャンネル信号処理回路，　３８　CPU，　４０　サーボDSP，　４５　ディスク

【図２】

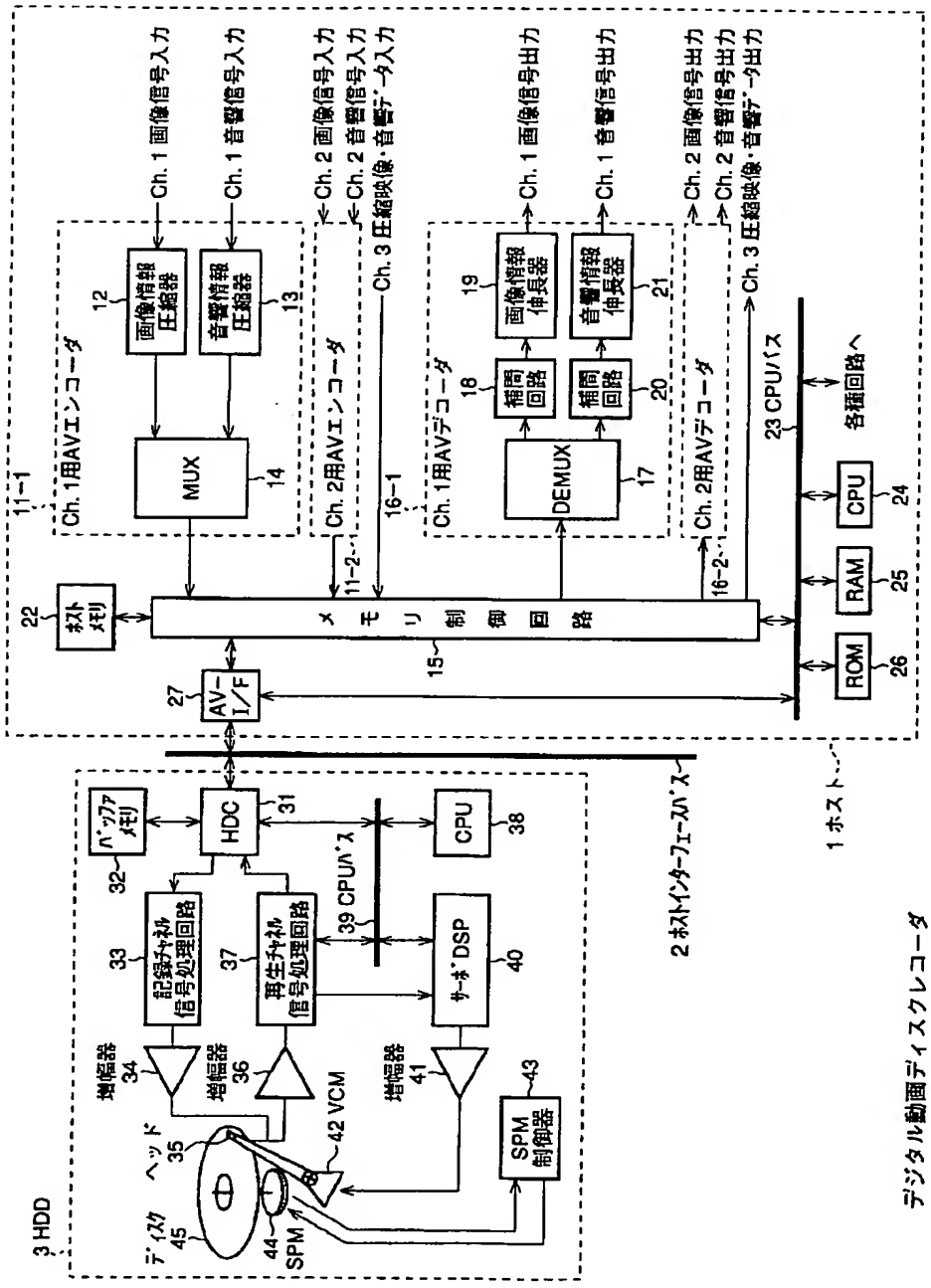


ホストのファームウエアの構成

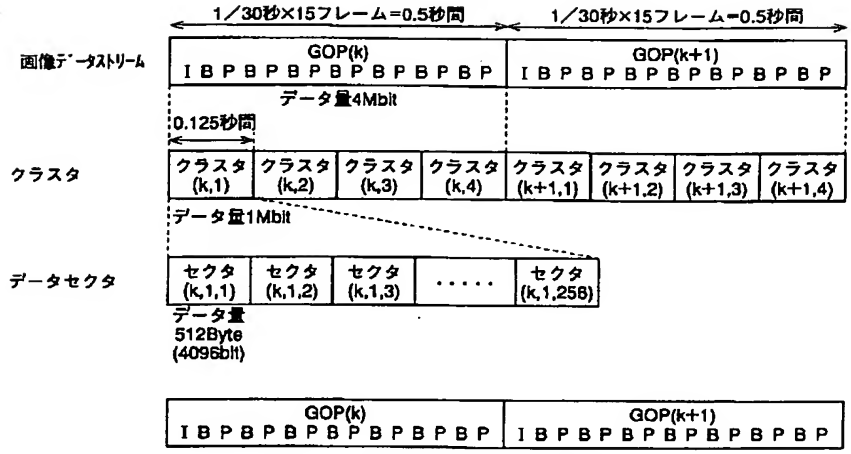
【図９】



【図１】

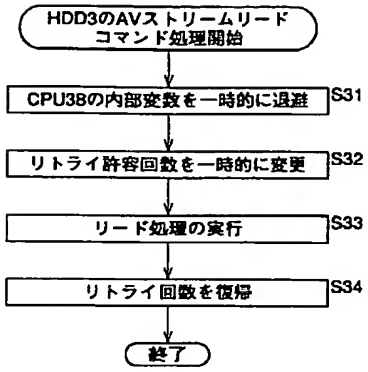

Ch. 1 画像信号入力
Ch. 1 音響信号入力
Ch. 2 画像信号入力
Ch. 2 音響信号入力
Ch. 3 圧縮映像・音響データ入力
Ch. 1 画像信号出力
Ch. 1 音響信号出力
Ch. 2 画像信号出力
Ch. 2 音響信号出力
Ch. 3 圧縮映像・音響データ出力
11-1
Ch. 1用AVエンコーダ
12
画像情報圧縮器
13
音響情報圧縮器
MUX
14
11-2-1
Ch. 2用AVエンコーダ
16-1
Ch. 1用AVデコーダ
19
画像情報伸長器
21
音響情報伸長器
18
補間回路
20
補間回路
DEMUX
17
16-2-1
Ch. 2用AVデコーダ
22
ホストI/F
メモリ制御回路
15
27
AV-I/F
23 CPUバス
CPU
24
RAM
25
ROM
26
各種回路へ
1 ホスト
2 ホストインターフェースバス
3 HDD
バッファメモリ
32
HDC
31
CPU
38
記録チャネル信号処理回路
33
再生チャネル信号処理回路
37
39 CPUバス
サーボDSP
40
増幅器
34
増幅器
36
増幅器
41
ヘッド
35
42 VCM
SPM制御器
43
ディスク
45
44
SPM
デジタル動画ディスクレコーダ

【図３】

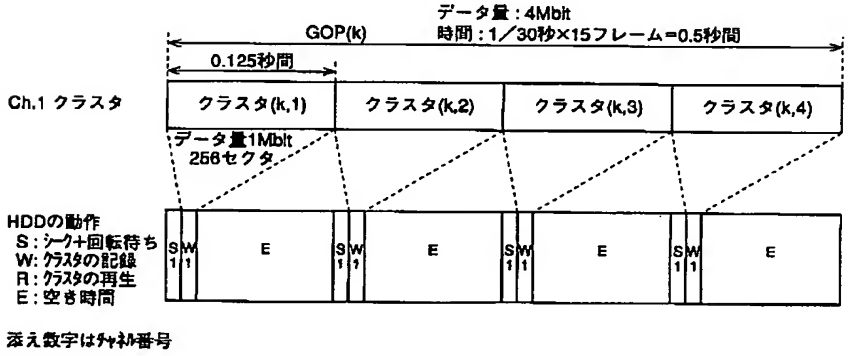


クラスタとMPEG2のGOPの関係

【図１２】



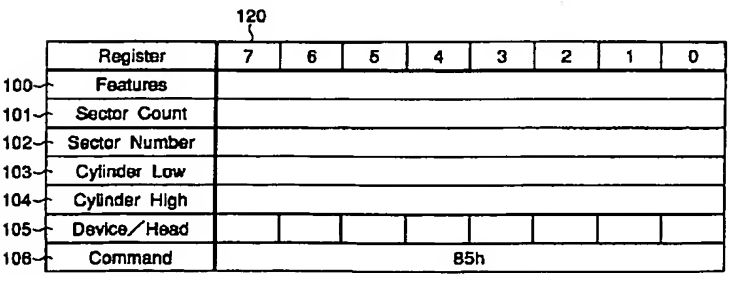
【図４】



添え数字はチャネル番号

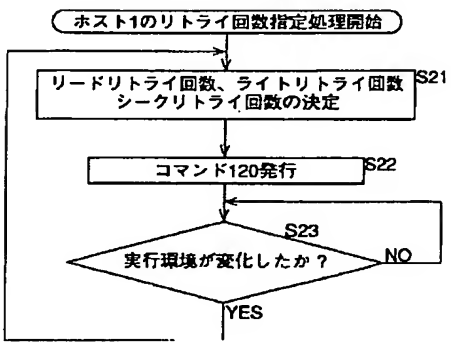
1本のAVデータストリームを記録する場合のHDDの動作
(MPEG2、8Mbit/sの場合、Ch. 1は記録、Ch. 2とCh. 3は休止)

【図７】

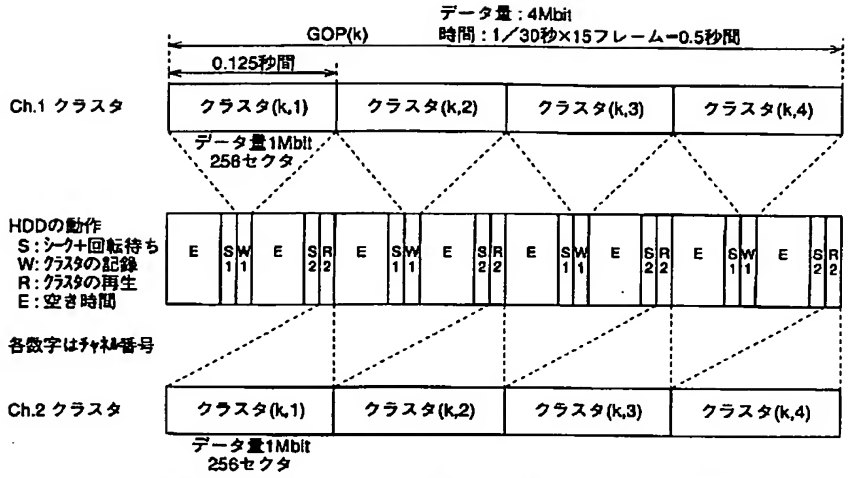


AVモード設定コマンド

【図１０】

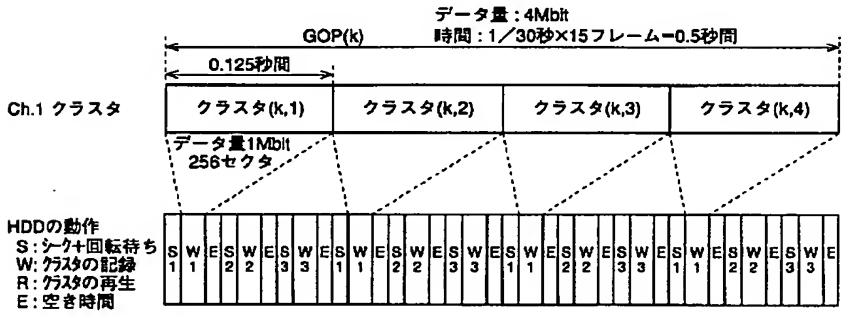


【図５】



複数のAVデータストリームを同時に記録／再生する場合のHDDの動作
(MPEG2、8Mbit/sの場合、Ch. 1は記録、Ch. 2は再生の場合)

【図６】



3本のAVデータストリームを同時に記録する場合のHDDの動作
(MPEG2、8Mbit/sの場合、Ch. 1、Ch. 2、Ch. 3共に記録)

【図８】

121

Byte	7	6	5	4	3	2	1	0
0	リードリトライ許容回数							
1	ライトリトライ許容回数							
2	シークリトライ許容回数							
3								
4								
5								
6−511								

AVモード設定パラメータ

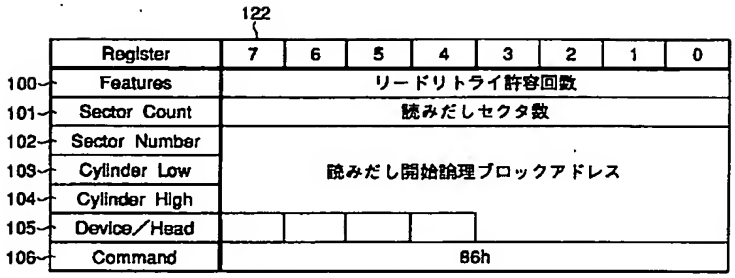
【図１８】

127

Byte	7	6	5	4	3	2	1	0
0	遅延情報							
1								
2								
3								
4								
5								
6−511								

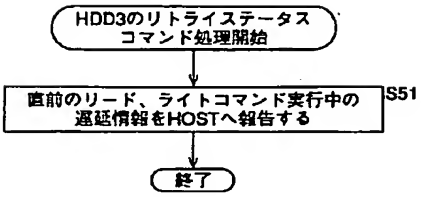
リトライステータス情報

【図１１】

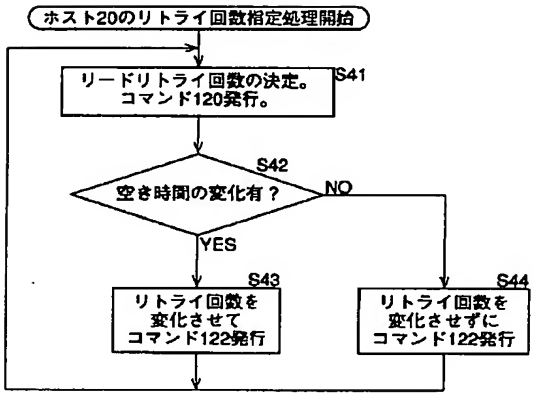


AVストリームリードコマンド

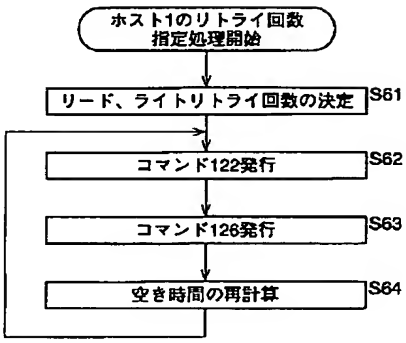
【図１９】



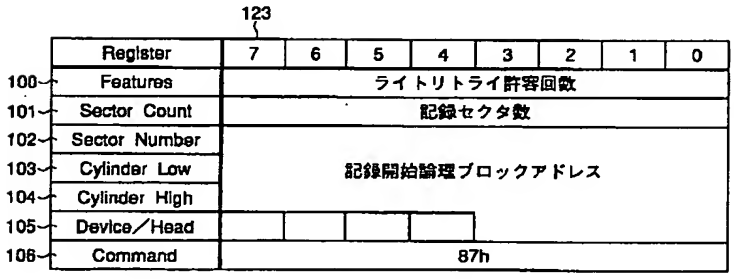
【図１３】



【図２０】

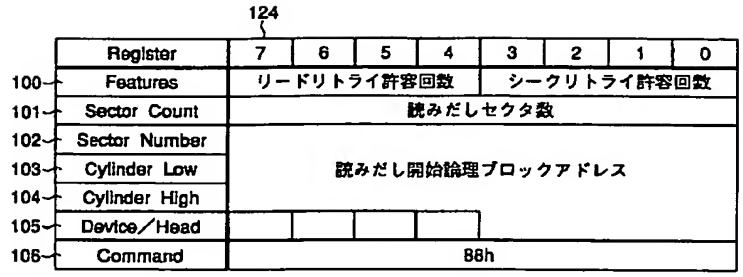


【図１４】



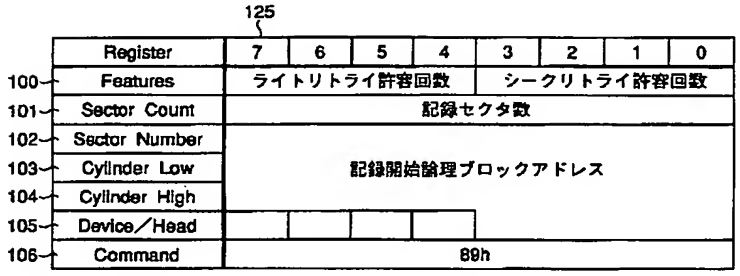
AVストリームライトコマンド

【図１５】



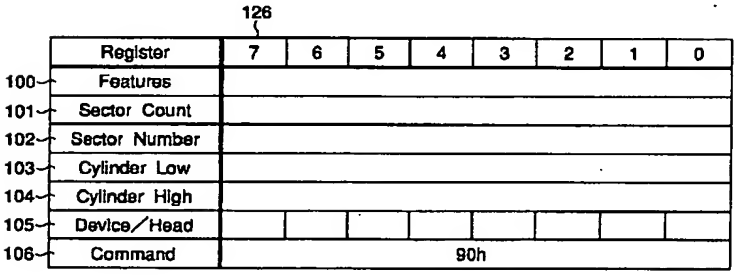
AVストリームリードコマンド(シークリトライ許容回数指定)

【図１６】



AVストリームライトコマンド(シークリトライ許容回数指定)

【図１７】



リトライステータスセンスコマンド

CLAIMS

[Claim(s)]
[Claim 1]Continuous picture information or sound information characterized by comprising the following which is connected to an information processor and supplied from said information processor, A recording medium driving device which reruns the operation when it records on a recording medium to build in, and said information reproduced from said recording medium is outputted to said information processor and operation of seeking, record, or reproduction has an error.
A control signal reception means which said information processor outputs and which receives a control signal which controls said rerun.
A rerun control means which controls said rerun based on said control signal which said information processor outputs.

[Claim 2]The recording medium driving device according to claim 1 having further a time delay transmitting means which transmits a time delay by said rerun to said information processor.
[Claim 3]The recording medium driving device according to claim 1, wherein said rerun control means controls a maximum allowable number or maximum-permissible time of said rerun.
[Claim 4]The recording medium driving device according to claim 3, wherein a maximum allowable number of said rerun has a direction larger than a case where operation of record or reproduction has an error in case there is an error by operation of seeking.
[Claim 5]The recording medium driving device according to claim 3 with which a direction in case there is an error by operation of seeking from a case where maximum-permissible time of said rerun has an error in operation of record or reproduction is characterized by a long time.
[Claim 6]The recording medium driving device according to claim 3 with which a maximum allowable number or maximum-permissible time of said rerun is characterized by said seeking, record, or reproduction changing dynamically working.

[Claim 7]Continuous picture information or sound information characterized by comprising the following which is connected to an information processor and supplied from said information processor, A recording-medium drive method of a recording medium driving device which reruns the operation when it records on a recording medium to build in, and said information reproduced from said recording medium is outputted to said information processor and operation of seeking, record, or reproduction has an error.
A control signal receiving step which said information processor outputs and which receives a control signal which controls said rerun.
A rerun control step which controls said rerun based on said control signal which said information processor outputs.

[Claim 8]A distribution medium providing a program which a computer characterized by comprising the following which performs processing can read.
Continuous picture information or sound information which is connected to an information processor and supplied from said information processor, Record on a recording medium to build in and said information reproduced from said recording medium is outputted to said information processor, And a control signal receiving step which said information processor outputs to a recording medium driving device which reruns the operation when operation of seeking, record, or reproduction has an error and which receives a control signal which controls said rerun.
A rerun control step which controls said rerun based on said control signal which said information processor outputs.

[Claim 9]An information processor which makes a recording medium in which it is contained by said recording medium driving device record or reproduce picture information or sound information which a recording medium driving device which reruns the operation is connected, and continues when operation of seeking and record characterized by comprising the following, or reproduction has an error.
A management tool which manages a time delay by said rerun when operation of seeking of said recording medium driving device, record, or reproduction has an error.
A generating means which generates a control signal which controls said rerun of said recording medium driving device based on said time delay which said management tool manages.
A transmitting means which transmits said control signal generated by said generating means to said recording medium driving device.

[Claim 10]The information processor according to claim 9, wherein said management tool

receives information about a time delay by said rerun which said recording medium driving device outputs.

[Claim 11]The information processor according to claim 9, wherein said generating means generates a control signal which controls a maximum allowable number or maximum-permissible time of said rerun.

[Claim 12]The information processor according to claim 11, wherein said generating means generates a control signal with which said recording medium driving device controls maximum-permissible time or a maximum allowable number of said rerun corresponding to the number of channels of information which performs record or reproduction simultaneously.

[Claim 13]The information processor according to claim 11, wherein said generating means generates a control signal which controls maximum-permissible time or a maximum allowable number of said rerun with a control signal which orders it operation of seeking, record, or reproduction.

[Claim 14]When operation of seeking and record characterized by comprising the following, or reproduction has an error, An information processing method of an information processor which a recording medium in which picture information or sound information which a recording medium driving device which reruns the operation is connected, and continues is contained by said recording medium driving device is made to record or reproduce.

A management step which manages a time delay by said rerun when operation of seeking of said recording medium driving device, record, or reproduction has an error.

A generating step which generates a control signal which controls said rerun of said recording medium driving device based on said time delay managed by said management step.

A transmission step which transmits said control signal generated at said generating step to said recording medium driving device.

[Claim 15]A distribution medium providing a program which a computer characterized by comprising the following which performs processing can read.

When operation of seeking, record, or reproduction has an error, a recording medium driving device which reruns the operation is connected, A management step which manages a time delay by said rerun when operation of seeking of said recording medium driving device, record, or reproduction has an error to an information processor which makes a recording medium in which it is contained by said recording medium driving device record or reproduce continuous picture information or sound information.

A generating step which generates a control signal which controls said rerun of said recording medium driving device based on said time delay managed by said management step.

A transmission step which transmits said control signal generated at said generating step to said recording medium driving device.

[Claim 16]It is connected to an information processor characterized by comprising the following, and said information processor, When operation of seeking, record, or reproduction has an error, record continuous picture information or sound information which reruns the operation and which was supplied from said information processor on a recording medium to build in, and. An information storage reproducing system which consists of a recording medium driving device which outputs said information reproduced from said recording medium to said information processor.
A control signal reception means to which said information processor outputs said recording medium driving device and which receives a control signal which controls said rerun.
A management tool which manages a time delay by said rerun when it has a rerun control means which controls said rerun based on said control signal which said information processor outputs and said information processor has an error in operation of seeking of said recording medium driving device, record, or reproduction.
A generating means which generates said control signal which controls said rerun of said recording medium driving device based on said time delay which said management tool manages.
A transmitting means which transmits said control signal generated by said generating means to said recording medium driving device.

[Claim 17]It is connected to an information processor characterized by comprising the following, and said information processor, When operation of seeking, record, or reproduction has an error, record continuous picture information or sound information which reruns the operation and which was supplied from said information processor on a recording medium to build in, and. An information storage regeneration method of an information storage reproducing system which consists of a recording medium driving device which outputs said information reproduced from said recording medium to said information processor.
A control signal receiving step to which said information processor outputs an information storage regeneration method of said recording medium driving device and which receives a control signal which controls said rerun.
Including a rerun control step which controls said rerun based on said control signal which said information processor outputs, an information storage regeneration method of said information processor, A management step which manages a time delay by said rerun when operation of seeking of said recording medium driving device, record, or reproduction has an error.
A generating step which generates a control signal which controls said rerun of said recording medium driving device based on said time delay managed by said management step.
A transmission step which transmits said control signal generated at said generating step to

said recording medium driving device.

[Claim 18]A distribution medium providing a program which a computer characterized by comprising the following which performs processing can read.
An information processor.
When it is connected to said information processor and operation of seeking, record, or reproduction has an error, record continuous picture information or sound information which reruns the operation and which was supplied from said information processor on a recording medium to build in, and. A control signal receiving step which receives a control signal with which said information processor outputs said information reproduced from said recording medium to said recording medium driving device of an information storage reproducing system which consists of a recording medium driving device outputted to said information processor, and which controls said rerun.
A management step which manages a time delay by said rerun when processing containing a rerun control step which controls said rerun is performed based on said control signal which said information processor outputs and said information processor has an error at operation of seeking of said recording medium driving device, record, or reproduction.
A generating step which generates a control signal which controls said rerun of said recording medium driving device based on said time delay managed by said management step, and a transmission step which transmits said control signal generated at said generating step to said recording medium driving device.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[Field of the Invention]This invention relates to a recording medium driving device and a method, an information storage reproducing system, a method, and a distribution medium, and relates to the recording medium driving device which records or reproduces real time continuous data, such as video, especially, for example and a method, an information storage reproducing system, a method, and a distribution medium.
[0002]
[Description of the Prior Art]Surface recording density of HDD (Hard Disk Drive) which is a typical magnetic disk drive is continuing improving 60% of an annual rate from around 1990 to the present by progress of magnetic head art, signal-processing art, etc. It is thought that 10 GB thru/or 20 GB of data can be recorded now on one disk of 3.5 inch diameters, and one set of HDD with the disk of two or more sheets comes to have the storage capacity of not less than 100 GB past 2000. . Therefore, were put in practical use in recent years. By using efficient digital dynamic image compression technology, such as DV (Digital Video) (transfer rate = 29Mbps) and MPEG 2 (Moving Picture Experts Group Phase-2) (transfer rate = 15Mbps), Utilization of recording or reproducing simultaneously the dynamic image information of two or more channels to HDD, i.e., a multichannel video disk recorder, is attained.
[0003]However, the improvement in technical in the direction which reliability is good and accesses what is called discrete text model data as quickly as possible and at random has been made from the history into which HDD has developed as a primary storage of a computer. Therefore, operation of HDD is discrete on a time-axis. Namely, the command of record, reproduction, etc. which were supplied to HDD from the host, It performed as discrete operation which became independent one [at a time], and in order to have guaranteed that recording operation or reproduction motion was completed within predetermined time

(guarantee of real-time requirement), it needed to restrict beforehand in the design stage of HDD so that operation of record or reproduction might complete operation of HDD within predetermined time.

[0004]

[Problem(s) to be Solved by the Invention]One of the factors which check reservation of this real-time requirement has the rerun (retry) of data recording/reproduction. When fault is found during [of a rerun (retry) of data recording/reproduction] the recording operation of data, or reproduction motion, it means performing the same operation again. Record/reproduction of the data in HDD are performed in the short data sector unit (for example, 512Byte unit) equivalent to the packet in communication technology.

[0005]When the track with which a target sector exists is not able to be discovered while moving the head to the track with which a target data sector exists in order to perform record/reproduction of data in HDD (in the case of a seek error), head movement is again performed to the data sector concerned (seeking retry). Correctly, record all the data of a target data sector group (for example, 512Byte unit), it is not reproduced, but a seek error may cause the huge burst error which cannot be corrected with an error correcting code (ECC), either. Therefore, although it is more desirable to perform a seeking retry, since the time for several ms thru/or about several 10 ms is needed for one seeking retry, real-time requirement reservation is checked.

[0006]By the mechanical shock etc. which were added from the outside during one record of a data sector at HDD, for example. When the position of a head shifts from data tracks, it waits a return on the original track of a head, and for the sector concerned to come again directly under a head by disk rotation, and data recording operation is again performed to the data sector concerned (light retry). Therefore, since continuous data recording operation once breaks off and disk rotation waiting time (it is 11 ms when revolving speed is 90 Hz) is originally needed when a light retry arises, real-time requirement is checked.

[0007]When the error of the quantity beyond the correcting capability of the error correcting code added to the sector at the time of reproduction of one data sector occurs and it is judged that correction is impossible, It waits for the sector concerned to come again directly under a head by rotation of a disk, and reproduction motion of the logical sector concerned is performed again (lead retry). Since continuous data reproduction operation originally once breaks off also in this case and disk rotation waiting time is needed, real-time requirement is checked. Even if it carries out a lead retry once [further], when it is judged with correction being impossible again, the 2nd lead retry is performed. When an error is a hardware error by random causes, such as a noise, even if it performs a lead retry 10 times or more, for example, it cannot read correctly, but thing retry time is needed 100 ms or more, and it becomes real-time requirement reservation with a fatal injury.

[0008]The maximum execution frequency of the various above-mentioned reruns is a value beforehand decided to be the design of HDD, and is not appropriately controlled according to the situation of the whole disk recorder. . [whether execution of a retry is extensively permitted from the former, and] Or although a means (for example, a part of ATA (AT-Attachment) interface standard of ANSI (American National Standards Institute)) to forbid is provided, If a retry is permitted extensively, a dead time will increase and it will become impossible to secure real time. On the contrary, when forbidding extensively, the burst error by seek error relief impossible was caused, and the technical problem that image quality deteriorated substantially occurred.
[0009]This invention is made in view of such a situation, and though image quality and reliability required as HDD are maintained by performing various reruns in the range which can secure real-time requirement, the continuous recording of video or real-time requirement required for reproduction is made not to be spoiled.
[0010]
[Means for Solving the Problem]written this invention is characterized by it having been alike and comprising the following at claim 1.
A control signal reception means which an information processor outputs and which receives a control signal which controls a rerun.
A rerun control means which controls a rerun based on a control signal which an information processor outputs.

[0011]Written this invention is characterized by a drive method comprising the following at claim 7.
A control signal receiving step which an information processor outputs and which receives a control signal which controls a rerun.
A rerun control step which controls a rerun based on a control signal which an information processor outputs.

[0012]A control signal receiving step to which an information processor outputs the distribution medium according to claim 8 and which receives a control signal which controls a rerun, Based on a control signal which an information processor outputs, a program which a computer which performs processing containing a rerun control step which controls a rerun can read is provided.
[0013]A management tool which manages a time delay by rerun when the information processor according to claim 9 has an error in operation of seeking of a recording medium driving device, record, or reproduction, Based on a time delay which a management tool manages, it has a generating means which generates a control signal which controls a rerun of

a recording medium driving device, and a transmitting means which transmits a control signal generated by a generating means to a recording medium driving device.

[0014]A management step which manages a time delay by rerun when the information processing method according to claim 14 has an error in operation of seeking of a recording medium driving device, record, or reproduction, Based on a time delay managed by a management step, a generating step which generates a control signal which controls a rerun of a recording medium driving device, and a transmission step which transmits a control signal generated at a generating step to a recording medium driving device are included.

[0015]A management step which manages a time delay by rerun when the distribution medium according to claim 15 has an error in operation of seeking of a recording medium driving device, record, or reproduction, A generating step which generates a control signal which controls a rerun of a recording medium driving device based on a time delay managed by a management step, A program which a computer which performs processing containing a transmission step which transmits a control signal generated at a generating step to a recording medium driving device can read is provided.

[0016]The information storage reproducing system according to claim 16, A control signal reception means to which an information processor outputs a recording medium driving device and which receives a control signal which controls a rerun, Based on a control signal which an information processor outputs, have a rerun control means which controls a rerun, and an information processor, A management tool which manages a time delay by rerun when operation of seeking of a recording medium driving device, record, or reproduction has an error, Based on a time delay which a management tool manages, it has a generating means which generates a control signal which controls a rerun of a recording medium driving device, and a transmitting means which transmits a control signal generated by a generating means to a recording medium driving device.

[0017]The information storage regeneration method according to claim 17 an information storage regeneration method of a recording medium driving device, A control signal receiving step which an information processor outputs and which receives a control signal which controls a rerun, Including a rerun control step which controls a rerun based on a control signal which an information processor outputs, an information storage regeneration method of an information processor, A management step which manages a time delay by said rerun when operation of seeking of a recording medium driving device, record, or reproduction has an error, Based on a time delay managed by a management step, a generating step which generates a control signal which controls a rerun of a recording medium driving device, and a transmission step which transmits a control signal generated at a generating step to a recording medium driving device are included.

[0018]A control signal receiving step to which an information processor outputs the distribution

medium according to claim 18 and which receives a control signal which controls a rerun, Based on a control signal which an information processor outputs, processing containing a rerun control step which controls a rerun is performed, A management step which manages a time delay by rerun when operation of seeking of a recording medium driving device, record, or reproduction has an error to an information processor, A generating step which generates a control signal which controls a rerun of a recording medium driving device based on a time delay managed by a management step, A program which a computer which performs processing containing a transmission step which transmits a control signal generated at a generating step to a recording medium driving device can read is provided.

[0019]In the recording medium driving device according to claim 1, the recording-medium drive method according to claim 7, and the distribution medium according to claim 8, When operation of seeking of a recording medium driving device, record, or reproduction has an error, a rerun of a recording medium driving device is controlled based on a control signal from an information processor.

[0020]In the information processor according to claim 9, the information processing method according to claim 14, and the distribution medium according to claim 15, when operation of seeking of a recording medium driving device, record, or reproduction has an error, a time delay by rerun of a recording medium driving device is managed by an information processor.

[0021]In the information storage reproducing system according to claim 16, the information storage regeneration method according to claim 17, and the distribution medium according to claim 18, When operation of seeking of a recording medium driving device, record, or reproduction has an error, a time delay by rerun of a record driving medium is managed, and a rerun is controlled by an information processor.

[0022]

[Embodiment of the Invention]Although an embodiment of the invention is described below, it is as follows, when an embodiment [/ in the parenthesis after each means] (however, an example) is added and the feature of this invention is described, in order to clarify correspondence relation between each means of an invention given in a claim, and following embodiments. However, of course, this statement does not mean limiting to what indicated each means.

[0023]written this invention is characterized by it having been alike and comprising the following at claim 1.

The control signal reception means which an information processor (for example, host 1 of drawing 1) outputs and which receives the control signal which controls a rerun (for example, HDC31 of drawing 1).

The rerun control means which controls a rerun based on the control signal which an information processor outputs (for example, CPU38 of drawing 1).

[0024]The recording medium driving device according to claim 2 is further provided with the time delay transmitting means (for example, step S51 of drawing 19) which transmits the time delay by rerun to said information processor.
[0025]The management tool (for example, step S21 of drawing 10) which manages the time delay by rerun when the information processor according to claim 9 has an error in operation of seeking of a recording medium driving device, record, or reproduction, The generating means (for example, step S22 of drawing 10) which generates the control signal which controls the rerun of a recording medium driving device based on the time delay which a management tool manages, It has a transmitting means (for example, memory control circuit 15 of drawing 1) which transmits the control signal generated by the generating means to a recording medium driving device.
[0026]The information storage reproducing system according to claim 16, The control signal reception means (for example, HDC31 of drawing 1) in which a recording medium driving device receives the control signal which an information processor outputs, and with which a rerun is controlled, The rerun control means which controls a rerun based on the control signal which an information processor outputs. (For example, CPU38 of drawing 1) The management tool (for example, step S21 of drawing 10) which manages the time delay by rerun when it has and an error has an information processor in operation of seeking of a recording medium driving device, record, or reproduction, The generating means (for example, step S22 of drawing 10) which generates the control signal which controls the rerun of a recording medium driving device based on the time delay which a management tool manages, It has a transmitting means (for example, memory control circuit 15 of drawing 1) which transmits the control signal generated by the generating means to a recording medium driving device.
[0027]The information storage reproducing system which applied this invention to below is explained. The following examples explain cover-half HDD as a typical example.
[0028]The example of composition of the digital image disk recorder as an information storage reproducing system which applied this invention is expressed to drawing 1. HDD3 is making it connect with the host 1 via the host interface bus 2. The AV (Audio Visual) encoder 11-1 of the host's 1 1st channel (Ch.1), The inputted picture signal for example, It has the multiplexer (MUX) 14 which compounds the output of the picture information compressor 12 compressed with an MPEG system (encoding), the sound information compressor 13 which compresses the audible signal corresponding to a picture signal with an MPEG system (encoding) and the picture information compressor 12, and the sound information compressor 13. Although the AV encoder 11-2 of the 2nd channel (Ch.2) is formed and a graphic display is omitted like the AV encoder 11-1 of the 1st channel, This AV encoder 11-2 also contains the picture information compressor which compresses the picture signal of the 2nd channel, the sound information

compressor which compresses the audible signal of the 2nd channel, and the multiplexer which carries out the multiplexer of those compression signals.

[0029]The signal outputted from the AV encoder 11-1 or the AV encoder 11-2 is inputted into the memory control circuit 15. The compressed image sound data of the 3rd channel (Ch.3) already compressed with the device which is not illustrated again is also inputted into the memory control circuit 15.

[0030]The host memory 22 is connected to the memory control circuit 15, and the data for one cluster as a unit recorded or played by the magnetic disk 45 (the disk 45 is only called hereafter) as HDD3 is memorized at least by this host memory 22 in it. The compressed image sound data into which the memory control circuit 15 is inputted from AV encoder 11-1,11-2, Or after supplying the compressed image sound data inputted in the state where it was already compressed to the host memory 22 and making it memorize, HDD3 is supplied via the host interface bus 2 from the AV-interface (I/F) 27. The regenerative data into which the memory control circuit 15 was inputted via the host interface bus 2 and AV interface 27 from HDD3, After making the host memory 22 once memorize, it is read suitably and it outputs to the device which is outputted to AV decoder 16-1,16-2, or is not illustrated as it is.

[0031]From the compressed image sound data inputted from the memory control circuit 15, AV decoder 16-1 of the 1st channel separates picture image data and sound data, and has the demultiplexer (DEMUX) 17 outputted to the interpolation circuit 18 and the interpolation circuit 20, respectively. The interpolation circuit 18 interpolates the error of the compression video data inputted from the demultiplexer 17, and is outputting it to the picture information expandor 19. The picture information expandor 19 performs elongation processing corresponding to the picture information compressor 12, and outputs the elongated picture signal to the device which is not illustrated. The interpolation circuit 20 interpolates the error of the sound data inputted from the demultiplexer 17, and is outputting it to the sound information expandor 21. The sound information expandor 21 develops and outputs the sound information inputted by the method corresponding to the sound information compressor 13 to the device which is not illustrated.

[0032]Although a graphic display is omitted, AV decoder 16-2 as well as AV decoder 16-1 builds in the demultiplexer, the interpolation circuit, the picture information expandor, and the sound information expandor.

[0033]In this example, one set of HDD40 is connected with the host 1 via the host interface bus 2, and it has composition which the compression animation and sound data of three channels can record or reproduce simultaneously. As the host interface bus 2, For example, the enhanced IDE (Integrated Device Electronics) standard (ATA (ATAttachment) standard) in ANSI (American National Standards Institute) is used. Operation of the whole disk recorder is managed by CPU24, the firmware is memorized by ROM26, and RAM25 is used as

workspace of CPU24. As a user interface mechanism for giving directions of operation from a user to a disk recorder, and telling a user about an operation situation from a disk recorder, A switch, a remote controller, a keyboard, a liquid crystal display, etc. which are not illustrated in particular are equipped, and CPU24 manages input and output with them.

[0034]Directions of the record over HDD3 or reproduction are performed when CPU24 makes the Write command or Read command defined as the enhanced IDE standard from AV-I/F27 via CPU bus 23 publish. The data transfer between host 1 and HDD3 is performed when CPU24 directs to the memory control circuit 15 and AV-I/F27.

[0035]HDD3 has the hard disk controller (HDC) 31, and HDC31, After making the buffer memory 32 once memorize the data inputted via the host interface bus 2, while reading this suitably and supplying the record channel signal processing circuit 33, After making the buffer memory 32 once memorize the regenerative data supplied from the channel reproduction digital disposal circuit 37, this is read suitably and it outputs via the host interface bus 2.

[0036]After the record channel signal processing circuit 33 modulates the inputted data with a predetermined modulation method, it is supplied to the magnetic head (a head is only called hereafter) 35 via the amplifier 34, and is made to record on the disk 45.

[0037]The head 35 plays the data currently recorded on the disk 45, and outputs it to the channel reproduction digital disposal circuit 37 via the amplifier 36. The channel reproduction digital disposal circuit 37 restores to the inputted data by the case in the record channel signal processing circuit 33, and a corresponding method, and outputs it to HDC31.

[0038]CPU38 is made via CPU bus 39 as [control / HDC31, the channel reproduction digital disposal circuit 37, the record channel signal processing circuit 33, etc.]. Servo DSP(digital signal processor) 40 generates a servo signal based on the regenerative data inputted from the channel reproduction digital disposal circuit 37, and outputs it to the voice coil motor (VCM) 42 via the amplifier 41. VCM42 transports the head 35 to the radial direction of the disk 45 corresponding to the inputted signal (seeking), and locates the head 35 on the predetermined track of the disk 45.

[0039]The spindle motor (SPM) controller 43 generates a control signal based on the FG signal and PG signal which the spindle motor (SPM) 44 outputs, and rotates the spindle motor 44 at the rate of predetermined.

[0040]It is stored in ROM26 and the hierarchy organization of the firmware which CPU24 performs is shown in drawing 2. It points to the user I/F part and the MPEG2 encoder decoder Management Department which perform input and output with said user interface mechanism in the 1st layer of a low rank, and the memory control circuit 15, The host memory Management Department which performs writing and read-out of the AV information stream to the host memory 22 and a cluster, and an HDD device driver are provided. These 1st layer is managed in the 2nd layer of a higher rank, and the system management software which

manages operation of the whole disk recorder is provided in it. All the things which are not contained in the 1st layer of the functions required for a digital animation disk recorder, such as record of each channel, directions of reproduction motion, grasp of the system operating status of each hardware resources, such as management, HDD3, and the host memory 22, and management, are contained in the function of system management software.

[0041]First, the flow of the signal at the time of the record in the whole digital animation disk recorder is explained. In the 1st channel (Ch.1), after the analog picture signal (for example, NTSC signal) inputted from the outside is digitized in the picture information compressor 12, a data rate is compressed to about 1/5. As a method of picture information compression, DV, MPEG 2, etc. are put in practical use and the amount of information is compressed to the original digital image information by performing a discrete cosine transform, inter-frame motion detection, re quantization, two-dimensional Huffman encoding, etc. The analog audible signal simultaneously inputted from the outside is also digitized by the sound information compressor 13, and a data rate is compressed. The multiplexer of the video information and sound information which were compressed is carried out by MUX14, and let them be an AV information stream. In now, the data rate of an AV information stream presupposes that they are 8 Mbit/s, using an MPEG2 system as video information compression technology.

[0042]This AV information stream is once memorized one by one by the host memory 22 via the memory control circuit 15. CPU24 takes out directions to the memory control circuit 15 according to the host memory Management Department of firmware, The cluster which is a mass of data which should be recorded on HDD3 is read from the host memory 22, and it is made to send and record on HDD3 through the host interface bus 2 via AV-I/F27.

[0043]The relation of GOP (Group of picture) defined as the data stream of MPEG 2 is indicated to be a cluster to drawing 3. In the example of drawing 3, the cluster is considered as the settlement of data which quadrisected and obtained GOP. Since GOP consists of a picture of 15 frames and one frame is equivalent to 1 / 30 seconds, one GOP is equivalent to 0.5 second, and if the bit rate considers it as 8 Mbit/s, the data volume will serve as 4Mbit. Therefore, the data volume of one cluster which quadrisected and obtained it is 1Mbit, and since the sector size of HDD3 is 512Byte (4096 bits), it is equivalent to the data volume for about 256 sectors. That is, whenever HDD3 receives a recording instruction from the host 1, it records an AV information stream on about 256 sectors continuously.

[0044]Operation of HDD3 at the time of record is as stating below. Since it is easy, as shown in drawing 4, the case where only one data stream of Ch.1 is recorded is mentioned as an example.

[0045]CPU24 sends a command to HDD3 so that one cluster which should be recorded may be continuously recorded as a data block of predetermined length from the predetermined logic block address of HDD3. HDC31 inside HDD3 receives this command and changes a

logic block address into the physical addresses inside HDD3 (a disc face number, a track number, a sector number, etc.) in collaboration with CPU38. Then, the data for one cluster (for example, data for 256 sectors) sent out from the host memory 22 is received by HDC31 via the host interface bus 2, and is once stored in the buffer memory 32.

[0046]HDC31 divides this data into the length (512Byte) of the logic data sector set up on the track of HDD3, It outputs to the record channel signal processing circuit 33, synchronizing with disk rotation, after adding the preamble pattern and error correcting code for taking a bit synchronization at the time of read-out and forming sector data before and after that furthermore. The record channel signal processing circuit 33 performs channel coding to the sector data, and changes it into the binary series which suited the characteristic of the magnetic-recording channel which consists of the head 35 and the disk 45. This binary series is matched with the recording current waveform of rectangular shape by the amplifier 34, and is recorded by the head 35 as a flux reversal pattern on the magnetic disk 45.

[0047]Since it is necessary to position the head 35 here to the target track which serves as a recording object beforehand, servo DSP40 which received target track numbers from HDC31 and CPU38, It positions by moving the head 35 to the physical address, receiving the track number on a disc face from the channel reproduction digital disposal circuit 37. In the above example, although the time which time usable to record of one cluster is 125 ms as shown in drawing 4, but seeking, rotational-delay operation (S1), and recording operation (W1) of HDD3 take is based also on the speed performance of HDD, it is about 30 ms and the remaining time turns into time (E) not much.

[0048]Next, the flow of the signal at the time of reproduction is explained.

[0049]First, according to the input from the user I/F part of firmware, system management software, Specify the AV information stream name which should be reproduced and it asks for the logic block address of HDD on which each cluster which constitutes the stream is recorded, An HDD device driver is made to publish the read-out command defined on the host interface bus 2 (for example, IDE-I/F), and the cluster concerned is made to read to it. The host memory Management Department makes the storage area for reconstructing a cluster in the host memory 22 secure through the memory control circuit 15 simultaneously.

[0050]The read-out command published on above-mentioned IDE-I/F is given to CPU38 via HDC31 of HDD3. CPU38 changes the logic block address of the cluster concerned into the physical addresses (a disc face number, a track number, a sector number, etc.) of the disk 45, orders servo DSP40 to perform it, moves the head 35 to the physical address, and makes read-out of data start. Namely, the flux reversal pattern recorded on the disk 45, After being read by the head 35 and amplified with the amplifier 36, a bit synchronization is taken by the channel reproduction digital disposal circuit 37, it is detected as a binary data series, decryption as inverse transformation of the channel coding performed at the time of record is

performed, and it is reproduced as sector data.

[0051]This sector data is sent to HDC31 and through error correction decoding as logical data of a 512-byte unit, After being accumulated in the buffer memory 32 one by one, via the host interface bus 2 and the memory control circuit 15, it is transmitted to the host memory 22 one by one, and one cluster is formed. If read-out of one cluster is completed, read-out of the cluster which follows is ordered similarly, from HDD3, a sector data constellation will be read and a succession cluster will be formed on the host memory 22. The formed cluster is read one by one and given to AV decoder 16-1 for Ch.1 as an AV information stream, for example.

[0052]This AV information stream is divided into picture image data and sound data by the demultiplexer 17. Picture image data is elongated by the usual digital image information by the picture information expandor 19 through the interpolation circuit 18 interpolated from the data of order, when an error exists in data. This picture information is changed into an NTSC analog video signal by the D/A converter etc., and is given to an external monitor etc.

[0053]As mentioned above, although the flow of the signal in the case where compressed image data is recorded, and the case of reproducing was explained only about Ch.1, it is as follows, when including the data of the 2nd channel (Ch.2) or the 3rd channel (Ch.3) and recording or reproducing two or more data streams.

[0054]The example of the timing chart in the case of reproducing the data stream of Ch.2 is shown in it at the same time it records the data stream of Ch.1 on drawing 5. In HDD3, only one cluster can be recorded or reproduced at once. Therefore, when processing the cluster for these two channels, record or reproduction is performed by turns. For example, in order to access the field which should record the cluster (k, 1) of Ch.1 first, seeking and rotational delay (S1) are performed and a cluster (k, 1) is recorded (W1). Next, idle time (E) is inserted, and in order to reproduce the cluster of Ch.2, seeking and rotational delay (S2) are performed. Since this seek operation has the common case where the cluster of these different **** channel exists in the track of a completely different radius on a disc face, it is needed. Next, a cluster (k, 1) is reproduced (R2). Then, operation of these series is repeated. In the example of drawing 5, even if it makes one set of HDD3 record / reproduce two channels simultaneously, a float (E) remains.

[0055]Drawing 6 shows the example of the timing chart in the case of recording three channels (Ch.1, Ch.2, Ch.3) simultaneously. From the host 1 side, three, the data stream which the AV encoder 11-1 for Ch.1 generates, the data stream which the encoder 11-2 for Ch.2 generates, and the data stream of the input of Ch.3, are once memorized by the host memory 22 through the memory control circuit 15. These three data streams are divided into a cluster, respectively, and are recorded on HDD3 with the Write command on the host interface bus 2 by turns. At once, HDD3 records only the cluster of one channel as well as the case of the two-channel simultaneous operation of above-mentioned drawing 5, advances record of three

channels by turns, and goes.

[0056]In this case, as shown in drawing 6, HDD3 is busy with operation of seeking and record, and idle time (E) becomes very short. Thus, when a disk recorder is simultaneously recorded or reproduced in the maximum number of channels that the speed performance of HDD3 allows, it is difficult to secure prolonged idle time.

[0057]The operation situation of HDD3 changes depending on the number of channels which the disk recorder is treating at the time so that explanation of the above disk recorder of operation may show. That is, in the example of the recorder in which a maximum of three-channel simultaneous record / reproduction is possible, although HDD3 has only slight idle time while carrying out three-channel simultaneous operation, in one-channel operation, remarkable idle time exists. In a actual operating condition, a disk recorder may be in the hibernation which it does not always continue operating, and the number of channels of operation certainly decreases, or is not recorded / reproduced at all with the number of the maximum possible channels. Since the system management software of a disk recorder grasps the operation situation of disk recorders, such as the number of channels of operation, the situation of the idle time of HDD3 can also grasp it.

[0058]So, in this invention, idle time or a quiescent period exists in HDD3 in a disk recorder, And in these idle time or a quiescent period paying attention to the system management software by the side of the host 1 grasping the situation of idle time, The host 1 controls so that HDD3 can perform the seeking retry described by the paragraph of the Prior art, a light retry, and a lead retry as much as possible.

[0059]For this reason, on the host interface bus 2, the command the host 1 instructs execution to be is established to a seeking retry, a light retry, and lead retry operation. By these commands, about a seeking retry, a light retry, and execution of lead retry operation, Host 1 and HDD3 is enabled to communicate, and a seeking retry required for the control of maintenance of the reliability of HDD3, a light retry, and lead retry operation can perform under the host's 1 management, as long as the operation situation of a disk recorder allows.

[0060]Below, the example of processing in case the host 1 manages execution is described about the seeking retry mentioned above, a light retry, and lead retry operation.

[0061]First, the 1st example of operation in the case of directing the number of times of permission of re-read-out when an error exists in the reproduced data from the host 1 is described.

[0062]For this reason, drawing 7 expresses the composition of the AV mode setting command 120 newly set up, and this command 120 is a command which sets up the operational mode in the writing of AV stream data, and read-out. The command identification code (for example, 85h) which specifies AV mode setting-operation is specified as the Command register 106. The data (parameter) 121 sent to HDD3 from CPU24 of the host 1 as data (parameter) of the

command 120, It is constituted as shown in drawing 8, and read-out of AV stream data, writing, and various parameters that specify the operational mode at the time of seeking are contained here. In this data 121, the retry time permitted to one command is specified at the time of reproduction and record. For example, in the example of drawing 8, the number of times of lead retry permission specifies the number of times of light retry permission as the byte 0 of the data 121, and it is specified as the byte 1 of the data 121, and the number of times of seeking retry permission is specified as the byte 2 of the data 121, respectively. As for other parameters, the graphic display is omitted in drawing 8.

[0063]When HDC31 and CPU38 in HDD3 receive the command 120 concerned and the parameter 121, it performs setting-operation of retry time as follows according to the flow chart shown in drawing 9. Although the parameter at the time of AV mode operation is contained in the operation parameters 121 besides retry time, these processings are not shown in drawing 9.

[0064]CPU38 changes the value of the variable of the retry maximum times about seeking, a lead, and a light memorized in an internal RAM area into the value to which it is directed with the parameter 121 of the command 120 (Step S11). CPU38 executes a light or a read command for the value of the variable concerned after this as a value of seeking, a lead, and the number of times of retry permission at the time of a light.

[0065]The host 1 can control the increase in the execution time per command by performing the above processings by specifying the number of times of retry permission per one command from the host 1.

[0066]CPU24 of the host 1 advances processing as follows according to the flow chart shown in drawing 10, when transmitting AV stream data between HDD3 using the AV mode setting command 120 defined as mentioned above.

[0067]CPU24 of the host 1 determines the retry time for carrying out record reproduction of the data of the predetermined number of channels into predetermined time in consideration of the present number of channels, idle time, a cluster size, etc. (Step S21). For example, what is necessary is just to write the data of 256 sectors in 0.125 second after being record of only one channel, and since there is much idle time E, retry time can be made to increase in the example of drawing 4 in the range which does not exceed idle time E. The example of drawing 6 is a case of simultaneous record of three channels, and there is less idle time E clearly than the case of drawing 4. In such a case, CPU24 will make judgment of lessening retry time.

[0068]Next, CPU24 of the host 1 publishes the command 120 and sets up the maximum retry time to HDD3 (Step S22). CPU24 repeats processing of Step S21 and S22, whenever change of execution environments, such as the number of record reproduction channels, idle time, and a cluster size, arises, and it sets up the optimal retry time (Step S23).

[0069]The number of times of permission of re-read-out when an error exists in the reproduced

data is described below about the 2nd example of operation in the case of directing from the host 1.

[0070]Drawing 11 expresses the composition of the AV stream read command 122 which is newly defined for this reason. When executing a read command and performing AV stream data transfer, the acceptable value of retry time effective only in the command is specified, for example using the Feature register 100. In the command 122, like the standard read command for ATA, To the Sector Count register 101, a read-out sector number, A read-out start logic block address is specified as 4 bits of low ranks of the Sector Number register 102, the Cylinder Low register 103, the Cylinder High register 104, and the Device/Head register 105. In the command 122, the command identification code (for example, 86h) which shows AV stream data read processing is specified as the Command register 106.

[0071]When HDC31 and CPU38 in HDD3 receive the command 122 concerned, it performs read-out of AV stream data as follows according to the flow chart shown in drawing 12.

[0072]CPU38 shunts temporarily the value of the variable of the retry maximum times of a lead memorized in an internal RAM area to another field (Step S31). And while accessing the field on the disk 45 specified by the command 122 at the following step S33, The value of the variable which has memorized the retry maximum times of a lead is changed into the value of the number of times of retry permission specified with the Features register 100 of the command 122 (Step S32), and reading processing is performed (Step S33). If reading processing is completed, the value of the retry maximum times which shunted temporarily at Step S31 will be returned (Step S34).

[0073]It enables CPU24 of the host 1 to control command execution time by performing the above processings more finely by specifying the number of times of retry permission for every command from the host 1. A temporary retry time change is attained efficiently, without using the command 120 of drawing 7.

[0074]CPU24 of the host 1 advances processing as follows according to the flow chart shown in drawing 13, when transmitting AV stream data between HDD3 using the AV stream read command 122 defined as mentioned above.

[0075]CPU24 of the host 1 takes into consideration the present number of channels, idle time, a cluster size, etc. like the 1st example of operation, The retry time for carrying out record reproduction of the data of the predetermined number of channels is determined in predetermined time (for example, the example of drawing 6 0.125 second), and the command 120 is published (Step S41). In the command 121, when retry time is specified and the command 120 is published supposing the worst case where a retry occurs by all the commands, supposing a retry does not occur actually, idle time will increase as it approaches in the end of predetermined time. Then, when it is judged whether idle time changed (Step S42) and it changes, in the AV stream data read command 122 published in the end of the

predetermined time concerned. Retry time can be increased temporarily and the probability of occurrence of a read error can be reduced (Step S43). When there is no change in idle time (Step S42), the command 122 is published, without changing retry time (Step S44).

[0076]Drawing 14 expresses the composition of the AV stream write command 123 newly defined. When executing a write command and performing AV stream data transfer, the Feature register 100 is used, for example and the acceptable value of retry time effective only in the command is specified. Also in the command 123, like the standard write command for ATA, To the Sector Count register 101, the number of recording sectors, A recording start logic block address is specified as 4 bits of low ranks of the Sector Number register 102, the Cylinder Low register 103, the Cylinder High register 104, and the Device/Head register 105. In the command 123, the command identification code (for example, 87h) which shows AV stream data write processing is specified as the Command register 106.

[0077]When HDC31 and CPU38 in HDD3 receive the command 123 concerned, it processes record of AV stream data like the case in the command 122.

[0078]The example of drawing 15 expresses the composition of the AV stream read command 124 with which the number of times of seeking retry permission is also newly specified. When executing a read command and performing AV stream data transfer, for example by the command 122, used the Feature register 100 and only the acceptable value of lead retry time effective only in the command was specified, but. In the command 124, the number of times of lead retry permission is specified as top 4 bits of the Feature register 100, and the acceptable value of seeking retry time is assigned to 4 bits of low ranks. In the command 124, the command identification code (for example, 88h) which shows AV stream data read processing is specified as the Command register 106.

[0079]The read error can aim at relief to some extent by interpolating from the data of order. However, on the other hand, a seek error may cause the burst error in which it is huge since all the data of a target sector data constellation is not read correctly. Therefore, the reliability of the read command of a disk recorder improves by securing the acceptable value of seeking retry time from the acceptable value of lead retry time more greatly. Therefore, CPU24 is controlled to always make the acceptable value of seeking retry time larger than the acceptable value of lead retry time.

[0080]When HDC31 and CPU38 in HDD3 receive the command 124 concerned, it processes record of AV stream data like the case in the command 122.

[0081]The example of drawing 16 expresses the composition of the AV stream write command 125 with which the number of times of seeking retry permission is also newly specified. Here, like the command 124, the number of times of lead retry permission is specified as top 4 bits of the Feature register 100, and the acceptable value of seeking retry time is assigned to 4 bits of low ranks. In the command 125, the command identification code (for example, 89h) which

shows AV stream data read processing is specified as the Command register 106. Thus, by specifying the acceptable value of seeking retry time, the reliability of the write command of a disk recorder as well as the command 124 improves.

[0082]When HDC31 and CPU38 in HDD3 receive the command 125 concerned, it processes record of AV stream data like the case in the command 122.

[0083]Next, the 3rd example of operation in the case of directing the number of times of permission of re-read-out when an error exists in the reproduced data from the host 1 is described.

[0084]Also in the 3rd example, like the 1st and 2nd examples of operation, retry time is specified using the AV mode setting command 120 and the data 121, and retry time is temporarily changed for every command using the command 122. In addition to these, the retry status sense command 126 shown in drawing 17 is newly defined by the 3rd example of operation. In the command 126, the command identification code (for example, 90h) which shows retry status sense command processing is specified as the Command register 106. The command 126 is reported in the last lead and a write command as the status information 127 which shows drawing 18 how much time delays which the retry of data or seeking generated owing to occurred. In the status information 127, the delaying amount by delay by seeking retry and data retry is described by a second bit or 1 circumference time basis of the disk 45 as delay time information by retry, for example.

[0085]When HDC31 and CPU38 in HDD3 receive the command 126 concerned, it is advanced as follows according to the flow chart which shows drawing 19 a report of the delay information which the retry produced owing to with the lead performed immediately before or a write command.

[0086]CPU38 measures the time delay generated in a lead and write command processing during execution of a command (for example, the example of drawing 13 step S43 or S44), and memorizes it in the memory to build in. CPU38 will be notified to CPU24 of the host 1 by making the time delay concerned into the status information 127, if the command 126 is received (Step S51). By publishing the command 126 from the host 1 by performing the above processings, CPU24 of the host 1 can grasp the delay time information by the actually generated retry, and it becomes possible to control finely the number of times of retry permission in subsequent commands.

[0087]When CPU24 of the host 1 transmits AV stream data between HDD3 using the lead for AV and the write command 126 which were defined as mentioned above, according to the flow chart shown in drawing 20, processing is advanced as follows.

[0088]CPU24 of the host 1 takes into consideration the present number of channels, idle time, a cluster size, etc. like the 1st and the 2nd example of operation, The retry time for carrying out record reproduction of the data of the predetermined number of channels is determined in

predetermined time (for example, the example of drawing 4 0.125 second), the command 120 is published, and the maximum retry time is set up (Step S61). Next, CPU24 publishes the command 122, reads data (Step S62), succeedingly, publishes the command 126 and obtains the delay information produced during execution of the command 122 concerned (Step S63). When the status information 127 corresponding to the command 126 comes to hand from HDD3, idle time is re-calculated based on delay information (Step S64). The idle time re-calculated here is referred to at the time of the determination of retry time, when publishing the following command 122.

[0089]In above three embodiments, although explained having set up the maximum allowable number of each retry as a limiting method of a retry, though the maximum-permissible time of each retry is set up as the 2nd limiting method, it is good.

[0090]Although the magnetic disk (hard disk) was explained above as an example as a recording medium, this invention can be applied also to recording media, such as optical discs other than a magnetic disk, and a magneto-optical disc.

[0091]It cannot be overemphasized that this invention is applicable also in the magnetic disk drive of removable HDD with an exchangeable disk or others.

[0092]In this specification, a system shall show the overall device which comprises two or more devices.

[0093]As a distribution medium which provides a user with the computer program which performs processing which was described above, communication media, such as a network, a satellite, etc. besides recording media, such as a magnetic disk, CD-ROM, and solid-state memory, can be used.

[0094]

[Effect of the Invention]According to the recording medium driving device according to claim 1, the recording-medium drive method according to claim 7, and the distribution medium according to claim 8. Since the rerun of a recording medium driving device is controlled based on the control signal from an information processor when operation of seeking of a recording medium driving device, record, or reproduction has an error, the recording medium driving device with which real-time requirement and reliability were guaranteed is realizable.

[0095]According to the information processor according to claim 9, the information processing method according to claim 14, and the distribution medium according to claim 15. Since the time delay by the rerun of a recording medium driving device is managed by an information processor when operation of seeking of a recording medium driving device, record, or reproduction has an error, real-time requirement and reliability are securable.

[0096]According to the information storage reproducing system according to claim 16, the information storage regeneration method according to claim 17, and the distribution medium according to claim 18. Since the time delay by the rerun of a record driving medium is

managed and a rerun is controlled by an information processor when operation of seeking of a recording medium driving device, record, or reproduction has an error, the system which secured real-time requirement and reliability is realizable.

[Translation done.]

* NOTICES *

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2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

TECHNICAL FIELD

[Field of the Invention]This invention relates to a recording medium driving device and a method, an information storage reproducing system, a method, and a distribution medium, and relates to the recording medium driving device which records or reproduces real time continuous data, such as video, especially, for example and a method, an information storage reproducing system, a method, and a distribution medium.

[Translation done.]

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PRIOR ART

[Description of the Prior Art]Surface recording density of HDD (Hard Disk Drive) which is a typical magnetic disk drive is continuing improving 60% of an annual rate from around 1990 to the present by progress of magnetic head art, signal-processing art, etc. It is thought that 10 GB thru/or 20 GB of data can be recorded now on one disk of 3.5 inch diameters, and one set of HDD with the disk of two or more sheets comes to have the storage capacity of not less than 100 GB past 2000. . Therefore, were put in practical use in recent years. By using efficient digital dynamic image compression technology, such as DV (Digital Video) (transfer rate = 29Mbps) and MPEG 2 (Moving Picture Experts Group Phase-2) (transfer rate = 15Mbps), Utilization of recording or reproducing simultaneously the dynamic image information of two or more channels to HDD, i.e., a multichannel video disk recorder, is attained.
[0003]However, the improvement in technical in the direction which reliability is good and accesses what is called discrete text model data as quickly as possible and at random has been made from the history into which HDD has developed as a primary storage of a computer. Therefore, operation of HDD is discrete on a time-axis. Namely, the command of record, reproduction, etc. which were supplied to HDD from the host, It performed as discrete operation which became independent one [at a time], and in order to have guaranteed that recording operation or reproduction motion was completed within predetermined time (guarantee of real-time requirement), it needed to restrict beforehand in the design stage of HDD so that operation of record or reproduction might complete operation of HDD within predetermined time.

[Translation done.]

EFFECT OF THE INVENTION

[Effect of the Invention]According to the recording medium driving device according to claim 1, the recording-medium drive method according to claim 7, and the distribution medium according to claim 8. Since the rerun of a recording medium driving device is controlled based on the control signal from an information processor when operation of seeking of a recording medium driving device, record, or reproduction has an error, the recording medium driving device with which real-time requirement and reliability were guaranteed is realizable.
[0095]According to the information processor according to claim 9, the information processing method according to claim 14, and the distribution medium according to claim 15. Since the time delay by the rerun of a recording medium driving device is managed by an information processor when operation of seeking of a recording medium driving device, record, or reproduction has an error, real-time requirement and reliability are securable.
[0096]According to the information storage reproducing system according to claim 16, the information storage regeneration method according to claim 17, and the distribution medium according to claim 18. Since the time delay by the rerun of a record driving medium is managed and a rerun is controlled by an information processor when operation of seeking of a recording medium driving device, record, or reproduction has an error, the system which secured real-time requirement and reliability is realizable.

[Translation done.]

TECHNICAL PROBLEM

[Problem(s) to be Solved by the Invention]One of the factors which check reservation of this real-time requirement has the rerun (retry) of data recording/reproduction. When fault is found during [of a rerun (retry) of data recording/reproduction] the recording operation of data, or reproduction motion, it means performing the same operation again. Record/reproduction of the data in HDD are performed in the short data sector unit (for example, 512Byte unit) equivalent to the packet in communication technology.

[0005]When the track with which a target sector exists is not able to be discovered while moving the head to the track with which a target data sector exists in order to perform record/reproduction of data in HDD (in the case of a seek error), head movement is again performed to the data sector concerned (seeking retry). Correctly, record all the data of a target data sector group (for example, 512Byte unit), it is not reproduced, but a seek error may cause the huge burst error which cannot be corrected with an error correcting code (ECC), either. Therefore, although it is more desirable to perform a seeking retry, since the time for several ms thru/or about several 10 ms is needed for one seeking retry, real-time requirement reservation is checked.

[0006]By the mechanical shock etc. which were added from the outside during one record of a data sector at HDD, for example. When the position of a head shifts from data tracks, it waits a return on the original track of a head, and for the sector concerned to come again directly under a head by disk rotation, and data recording operation is again performed to the data sector concerned (light retry). Therefore, since continuous data recording operation once breaks off and disk rotation waiting time (it is 11 ms when revolving speed is 90 Hz) is originally needed when a light retry arises, real-time requirement is checked.

[0007]When the error of the quantity beyond the correcting capability of the error correcting code added to the sector at the time of reproduction of one data sector occurs and it is judged that correction is impossible, It waits for the sector concerned to come again directly under a

head by rotation of a disk, and reproduction motion of the logical sector concerned is performed again (lead retry). Since continuous data reproduction operation originally once breaks off also in this case and disk rotation waiting time is needed, real-time requirement is checked. Even if it carries out a lead retry once [further], when it is judged with correction being impossible again, the 2nd lead retry is performed. When an error is a hardware error by random causes, such as a noise, even if it performs a lead retry 10 times or more, for example, it cannot read correctly, but thing retry time is needed 100 ms or more, and it becomes real-time requirement reservation with a fatal injury.

[0008]The maximum execution frequency of the various above-mentioned reruns is a value beforehand decided to be the design of HDD, and is not appropriately controlled according to the situation of the whole disk recorder. . [whether execution of a retry is extensively permitted from the former, and] Or although a means (for example, a part of ATA (AT-Attachment) interface standard of ANSI (American National Standards Institute)) to forbid is provided, If a retry is permitted extensively, a dead time will increase and it will become impossible to secure real time. On the contrary, when forbidding extensively, the burst error by seek error relief impossible was caused, and the technical problem that image quality deteriorated substantially occurred.

[0009]This invention is made in view of such a situation, and though image quality and reliability required as HDD are maintained by performing various reruns in the range which can secure real-time requirement, the continuous recording of video or real-time requirement required for reproduction is made not to be spoiled.

[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

MEANS

[Means for Solving the Problem]written this invention is characterized by it having been alike and comprising the following at claim 1.
A control signal reception means which an information processor outputs and which receives a control signal which controls a rerun.
A rerun control means which controls a rerun based on a control signal which an information processor outputs.

[0011]Written this invention is characterized by a drive method comprising the following at claim 7.
A control signal receiving step which an information processor outputs and which receives a control signal which controls a rerun.
A rerun control step which controls a rerun based on a control signal which an information processor outputs.

[0012]A control signal receiving step to which an information processor outputs the distribution medium according to claim 8 and which receives a control signal which controls a rerun, Based on a control signal which an information processor outputs, a program which a computer which performs processing containing a rerun control step which controls a rerun can read is provided.
[0013]A management tool which manages a time delay by rerun when the information processor according to claim 9 has an error in operation of seeking of a recording medium driving device, record, or reproduction, Based on a time delay which a management tool manages, it has a generating means which generates a control signal which controls a rerun of a recording medium driving device, and a transmitting means which transmits a control signal generated by a generating means to a recording medium driving device.

[0014]A management step which manages a time delay by rerun when the information processing method according to claim 14 has an error in operation of seeking of a recording medium driving device, record, or reproduction, Based on a time delay managed by a management step, a generating step which generates a control signal which controls a rerun of a recording medium driving device, and a transmission step which transmits a control signal generated at a generating step to a recording medium driving device are included.
[0015]A management step which manages a time delay by rerun when the distribution medium according to claim 15 has an error in operation of seeking of a recording medium driving device, record, or reproduction, A generating step which generates a control signal which controls a rerun of a recording medium driving device based on a time delay managed by a management step, A program which a computer which performs processing containing a transmission step which transmits a control signal generated at a generating step to a recording medium driving device can read is provided.
[0016]The information storage reproducing system according to claim 16, A control signal reception means to which an information processor outputs a recording medium driving device and which receives a control signal which controls a rerun, Based on a control signal which an information processor outputs, have a rerun control means which controls a rerun, and an information processor, A management tool which manages a time delay by rerun when operation of seeking of a recording medium driving device, record, or reproduction has an error, Based on a time delay which a management tool manages, it has a generating means which generates a control signal which controls a rerun of a recording medium driving device, and a transmitting means which transmits a control signal generated by a generating means to a recording medium driving device.
[0017]The information storage regeneration method according to claim 17 an information storage regeneration method of a recording medium driving device, A control signal receiving step which an information processor outputs and which receives a control signal which controls a rerun, Including a rerun control step which controls a rerun based on a control signal which an information processor outputs, an information storage regeneration method of an information processor, A management step which manages a time delay by said rerun when operation of seeking of a recording medium driving device, record, or reproduction has an error, Based on a time delay managed by a management step, a generating step which generates a control signal which controls a rerun of a recording medium driving device, and a transmission step which transmits a control signal generated at a generating step to a recording medium driving device are included.
[0018]A control signal receiving step to which an information processor outputs the distribution medium according to claim 18 and which receives a control signal which controls a rerun, Based on a control signal which an information processor outputs, processing containing a

rerun control step which controls a rerun is performed, A management step which manages a time delay by rerun when operation of seeking of a recording medium driving device, record, or reproduction has an error to an information processor, A generating step which generates a control signal which controls a rerun of a recording medium driving device based on a time delay managed by a management step, A program which a computer which performs processing containing a transmission step which transmits a control signal generated at a generating step to a recording medium driving device can read is provided.

[0019]In the recording medium driving device according to claim 1, the recording-medium drive method according to claim 7, and the distribution medium according to claim 8, When operation of seeking of a recording medium driving device, record, or reproduction has an error, a rerun of a recording medium driving device is controlled based on a control signal from an information processor.

[0020]In the information processor according to claim 9, the information processing method according to claim 14, and the distribution medium according to claim 15, when operation of seeking of a recording medium driving device, record, or reproduction has an error, a time delay by rerun of a recording medium driving device is managed by an information processor.

[0021]In the information storage reproducing system according to claim 16, the information storage regeneration method according to claim 17, and the distribution medium according to claim 18, When operation of seeking of a recording medium driving device, record, or reproduction has an error, a time delay by rerun of a record driving medium is managed, and a rerun is controlled by an information processor.

[0022]

[Embodiment of the Invention]Although an embodiment of the invention is described below, it is as follows, when an embodiment [/ in the parenthesis after each means] (however, an example) is added and the feature of this invention is described, in order to clarify correspondence relation between each means of an invention given in a claim, and following embodiments. However, of course, this statement does not mean limiting to what indicated each means.

[0023]written this invention is characterized by it having been alike and comprising the following at claim 1.

The control signal reception means which an information processor (for example, host 1 of drawing 1) outputs and which receives the control signal which controls a rerun (for example, HDC31 of drawing 1).

The rerun control means which controls a rerun based on the control signal which an information processor outputs (for example, CPU38 of drawing 1).

[0024]The recording medium driving device according to claim 2 is further provided with the

time delay transmitting means (for example, step S51 of drawing 19) which transmits the time delay by rerun to said information processor.

[0025]The management tool (for example, step S21 of drawing 10) which manages the time delay by rerun when the information processor according to claim 9 has an error in operation of seeking of a recording medium driving device, record, or reproduction, The generating means (for example, step S22 of drawing 10) which generates the control signal which controls the rerun of a recording medium driving device based on the time delay which a management tool manages, It has a transmitting means (for example, memory control circuit 15 of drawing 1) which transmits the control signal generated by the generating means to a recording medium driving device.

[0026]The information storage reproducing system according to claim 16, The control signal reception means (for example, HDC31 of drawing 1) in which a recording medium driving device receives the control signal which an information processor outputs, and with which a rerun is controlled, The rerun control means which controls a rerun based on the control signal which an information processor outputs. (For example, CPU38 of drawing 1) The management tool (for example, step S21 of drawing 10) which manages the time delay by rerun when it has and an error has an information processor in operation of seeking of a recording medium driving device, record, or reproduction, The generating means (for example, step S22 of drawing 10) which generates the control signal which controls the rerun of a recording medium driving device based on the time delay which a management tool manages, It has a transmitting means (for example, memory control circuit 15 of drawing 1) which transmits the control signal generated by the generating means to a recording medium driving device.

[0027]The information storage reproducing system which applied this invention to below is explained. The following examples explain cover-half HDD as a typical example.

[0028]The example of composition of the digital image disk recorder as an information storage reproducing system which applied this invention is expressed to drawing 1. HDD3 is making it connect with the host 1 via the host interface bus 2. The AV (Audio Visual) encoder 11-1 of the host's 1 1st channel (Ch.1), The inputted picture signal for example, It has the multiplexer (MUX) 14 which compounds the output of the picture information compressor 12 compressed with an MPEG system (encoding), the sound information compressor 13 which compresses the audible signal corresponding to a picture signal with an MPEG system (encoding) and the picture information compressor 12, and the sound information compressor 13. Although the AV encoder 11-2 of the 2nd channel (Ch.2) is formed and a graphic display is omitted like the AV encoder 11-1 of the 1st channel, This AV encoder 11-2 also contains the picture information compressor which compresses the picture signal of the 2nd channel, the sound information compressor which compresses the audible signal of the 2nd channel, and the multiplexer which carries out the multiplexer of those compression signals.

[0029]The signal outputted from the AV encoder 11-1 or the AV encoder 11-2 is inputted into the memory control circuit 15. The compressed image sound data of the 3rd channel (Ch.3) already compressed with the device which is not illustrated again is also inputted into the memory control circuit 15.

[0030]The host memory 22 is connected to the memory control circuit 15, and the data for one cluster as a unit recorded or played by the magnetic disk 45 (the disk 45 is only called hereafter) as HDD3 is memorized at least by this host memory 22 in it. The compressed image sound data into which the memory control circuit 15 is inputted from AV encoder 11-1,11-2, Or after supplying the compressed image sound data inputted in the state where it was already compressed to the host memory 22 and making it memorize, HDD3 is supplied via the host interface bus 2 from the AV-interface (I/F) 27. The regenerative data into which the memory control circuit 15 was inputted via the host interface bus 2 and AV interface 27 from HDD3, After making the host memory 22 once memorize, it is read suitably and it outputs to the device which is outputted to AV decoder 16-1,16-2, or is not illustrated as it is.

[0031]From the compressed image sound data inputted from the memory control circuit 15, AV decoder 16-1 of the 1st channel separates picture image data and sound data, and has the demultiplexer (DEMUX) 17 outputted to the interpolation circuit 18 and the interpolation circuit 20, respectively. The interpolation circuit 18 interpolates the error of the compression video data inputted from the demultiplexer 17, and is outputting it to the picture information expandor 19. The picture information expandor 19 performs elongation processing corresponding to the picture information compressor 12, and outputs the elongated picture signal to the device which is not illustrated. The interpolation circuit 20 interpolates the error of the sound data inputted from the demultiplexer 17, and is outputting it to the sound information expandor 21. The sound information expandor 21 develops and outputs the sound information inputted by the method corresponding to the sound information compressor 13 to the device which is not illustrated.

[0032]Although a graphic display is omitted, AV decoder 16-2 as well as AV decoder 16-1 builds in the demultiplexer, the interpolation circuit, the picture information expandor, and the sound information expandor.

[0033]In this example, one set of HDD40 is connected with the host 1 via the host interface bus 2, and it has composition which the compression animation and sound data of three channels can record or reproduce simultaneously. As the host interface bus 2, For example, the enhanced IDE (Integrated Device Electronics) standard (ATA (ATAttachment) standard) in ANSI (American National Standards Institute) is used. Operation of the whole disk recorder is managed by CPU24, the firmware is memorized by ROM26, and RAM25 is used as workspace of CPU24. As a user interface mechanism for giving directions of operation from a user to a disk recorder, and telling a user about an operation situation from a disk recorder, A

switch, a remote controller, a keyboard, a liquid crystal display, etc. which are not illustrated in particular are equipped, and CPU24 manages input and output with them.

[0034]Directions of the record over HDD3 or reproduction are performed when CPU24 makes the Write command or Read command defined as the enhanced IDE standard from AV-I/F27 via CPU bus 23 publish. The data transfer between host 1 and HDD3 is performed when CPU24 directs to the memory control circuit 15 and AV-I/F27.

[0035]HDD3 has the hard disk controller (HDC) 31, and HDC31, After making the buffer memory 32 once memorize the data inputted via the host interface bus 2, while reading this suitably and supplying the record channel signal processing circuit 33, After making the buffer memory 32 once memorize the regenerative data supplied from the channel reproduction digital disposal circuit 37, this is read suitably and it outputs via the host interface bus 2.

[0036]After the record channel signal processing circuit 33 modulates the inputted data with a predetermined modulation method, it is supplied to the magnetic head (a head is only called hereafter) 35 via the amplifier 34, and is made to record on the disk 45.

[0037]The head 35 plays the data currently recorded on the disk 45, and outputs it to the channel reproduction digital disposal circuit 37 via the amplifier 36. The channel reproduction digital disposal circuit 37 restores to the inputted data by the case in the record channel signal processing circuit 33, and a corresponding method, and outputs it to HDC31.

[0038]CPU38 is made via CPU bus 39 as [control / HDC31, the channel reproduction digital disposal circuit 37, the record channel signal processing circuit 33, etc.]. Servo DSP(digital signal processor) 40 generates a servo signal based on the regenerative data inputted from the channel reproduction digital disposal circuit 37, and outputs it to the voice coil motor (VCM) 42 via the amplifier 41. VCM42 transports the head 35 to the radial direction of the disk 45 corresponding to the inputted signal (seeking), and locates the head 35 on the predetermined track of the disk 45.

[0039]The spindle motor (SPM) controller 43 generates a control signal based on the FG signal and PG signal which the spindle motor (SPM) 44 outputs, and rotates the spindle motor 44 at the rate of predetermined.

[0040]It is stored in ROM26 and the hierarchy organization of the firmware which CPU24 performs is shown in drawing 2. It points to the user I/F part and the MPEG2 encoder decoder Management Department which perform input and output with said user interface mechanism in the 1st layer of a low rank, and the memory control circuit 15, The host memory Management Department which performs writing and read-out of the AV information stream to the host memory 22 and a cluster, and an HDD device driver are provided. These 1st layer is managed in the 2nd layer of a higher rank, and the system management software which manages operation of the whole disk recorder is provided in it. All the things which are not contained in the 1st layer of the functions required for a digital animation disk recorder, such as

record of each channel, directions of reproduction motion, grasp of the system operating status of each hardware resources, such as management, HDD3, and the host memory 22, and management, are contained in the function of system management software.

[0041]First, the flow of the signal at the time of the record in the whole digital animation disk recorder is explained. In the 1st channel (Ch.1), after the analog picture signal (for example, NTSC signal) inputted from the outside is digitized in the picture information compressor 12, a data rate is compressed to about 1/5. As a method of picture information compression, DV, MPEG 2, etc. are put in practical use and the amount of information is compressed to the original digital image information by performing a discrete cosine transform, inter-frame motion detection, re quantization, two-dimensional Huffman encoding, etc. The analog audible signal simultaneously inputted from the outside is also digitized by the sound information compressor 13, and a data rate is compressed. The multiplexer of the video information and sound information which were compressed is carried out by MUX14, and let them be an AV information stream. In now, the data rate of an AV information stream presupposes that they are 8 Mbit/s, using an MPEG2 system as video information compression technology.

[0042]This AV information stream is once memorized one by one by the host memory 22 via the memory control circuit 15. CPU24 takes out directions to the memory control circuit 15 according to the host memory Management Department of firmware, The cluster which is a mass of data which should be recorded on HDD3 is read from the host memory 22, and it is made to send and record on HDD3 through the host interface bus 2 via AV-I/F27.

[0043]The relation of GOP (Group of picture) defined as the data stream of MPEG 2 is indicated to be a cluster to drawing 3. In the example of drawing 3, the cluster is considered as the settlement of data which quadrisected and obtained GOP. Since GOP consists of a picture of 15 frames and one frame is equivalent to 1 / 30 seconds, one GOP is equivalent to 0.5 second, and if the bit rate considers it as 8 Mbit/s, the data volume will serve as 4Mbit. Therefore, the data volume of one cluster which quadrisected and obtained it is 1Mbit, and since the sector size of HDD3 is 512Byte (4096 bits), it is equivalent to the data volume for about 256 sectors. That is, whenever HDD3 receives a recording instruction from the host 1, it records an AV information stream on about 256 sectors continuously.

[0044]Operation of HDD3 at the time of record is as stating below. Since it is easy, as shown in drawing 4, the case where only one data stream of Ch.1 is recorded is mentioned as an example.

[0045]CPU24 sends a command to HDD3 so that one cluster which should be recorded may be continuously recorded as a data block of predetermined length from the predetermined logic block address of HDD3. HDC31 inside HDD3 receives this command and changes a logic block address into the physical addresses inside HDD3 (a disc face number, a track number, a sector number, etc.) in collaboration with CPU38. Then, the data for one cluster (for

example, data for 256 sectors) sent out from the host memory 22 is received by HDC31 via the host interface bus 2, and is once stored in the buffer memory 32.

[0046]HDC31 divides this data into the length (512Byte) of the logic data sector set up on the track of HDD3, It outputs to the record channel signal processing circuit 33, synchronizing with disk rotation, after adding the preamble pattern and error correcting code for taking a bit synchronization at the time of read-out and forming sector data before and after that furthermore. The record channel signal processing circuit 33 performs channel coding to the sector data, and changes it into the binary series which suited the characteristic of the magnetic-recording channel which consists of the head 35 and the disk 45. This binary series is matched with the recording current waveform of rectangular shape by the amplifier 34, and is recorded by the head 35 as a flux reversal pattern on the magnetic disk 45.

[0047]Since it is necessary to position the head 35 here to the target track which serves as a recording object beforehand, servo DSP40 which received target track numbers from HDC31 and CPU38, It positions by moving the head 35 to the physical address, receiving the track number on a disc face from the channel reproduction digital disposal circuit 37. In the above example, although the time which time usable to record of one cluster is 125 ms as shown in drawing 4, but seeking, rotational-delay operation (S1), and recording operation (W1) of HDD3 take is based also on the speed performance of HDD, it is about 30 ms and the remaining time turns into time (E) not much.

[0048]Next, the flow of the signal at the time of reproduction is explained.

[0049]First, according to the input from the user I/F part of firmware, system management software, Specify the AV information stream name which should be reproduced and it asks for the logic block address of HDD on which each cluster which constitutes the stream is recorded, An HDD device driver is made to publish the read-out command defined on the host interface bus 2 (for example, IDE-I/F), and the cluster concerned is made to read to it. The host memory Management Department makes the storage area for reconstructing a cluster in the host memory 22 secure through the memory control circuit 15 simultaneously.

[0050]The read-out command published on above-mentioned IDE-I/F is given to CPU38 via HDC31 of HDD3. CPU38 changes the logic block address of the cluster concerned into the physical addresses (a disc face number, a track number, a sector number, etc.) of the disk 45, orders servo DSP40 to perform it, moves the head 35 to the physical address, and makes read-out of data start. Namely, the flux reversal pattern recorded on the disk 45, After being read by the head 35 and amplified with the amplifier 36, a bit synchronization is taken by the channel reproduction digital disposal circuit 37, it is detected as a binary data series, decryption as inverse transformation of the channel coding performed at the time of record is performed, and it is reproduced as sector data.

[0051]This sector data is sent to HDC31 and through error correction decoding as logical data

of a 512-byte unit, After being accumulated in the buffer memory 32 one by one, via the host interface bus 2 and the memory control circuit 15, it is transmitted to the host memory 22 one by one, and one cluster is formed. If read-out of one cluster is completed, read-out of the cluster which follows is ordered similarly, from HDD3, a sector data constellation will be read and a succession cluster will be formed on the host memory 22. The formed cluster is read one by one and given to AV decoder 16-1 for Ch.1 as an AV information stream, for example.
[0052]This AV information stream is divided into picture image data and sound data by the demultiplexer 17. Picture image data is elongated by the usual digital image information by the picture information expandor 19 through the interpolation circuit 18 interpolated from the data of order, when an error exists in data. This picture information is changed into an NTSC analog video signal by the D/A converter etc., and is given to an external monitor etc.
[0053]As mentioned above, although the flow of the signal in the case where compressed image data is recorded, and the case of reproducing was explained only about Ch.1, it is as follows, when including the data of the 2nd channel (Ch.2) or the 3rd channel (Ch.3) and recording or reproducing two or more data streams.
[0054]The example of the timing chart in the case of reproducing the data stream of Ch.2 is shown in it at the same time it records the data stream of Ch.1 on drawing 5. In HDD3, only one cluster can be recorded or reproduced at once. Therefore, when processing the cluster for these two channels, record or reproduction is performed by turns. For example, in order to access the field which should record the cluster (k, 1) of Ch.1 first, seeking and rotational delay (S1) are performed and a cluster (k, 1) is recorded (W1). Next, idle time (E) is inserted, and in order to reproduce the cluster of Ch.2, seeking and rotational delay (S2) are performed. Since this seek operation has the common case where the cluster of these different **** channel exists in the track of a completely different radius on a disc face, it is needed. Next, a cluster (k, 1) is reproduced (R2). Then, operation of these series is repeated. In the example of drawing 5, even if it makes one set of HDD3 record / reproduce two channels simultaneously, a float (E) remains.
[0055]Drawing 6 shows the example of the timing chart in the case of recording three channels (Ch.1, Ch.2, Ch.3) simultaneously. From the host 1 side, three, the data stream which the AV encoder 11-1 for Ch.1 generates, the data stream which the encoder 11-2 for Ch.2 generates, and the data stream of the input of Ch.3, are once memorized by the host memory 22 through the memory control circuit 15. These three data streams are divided into a cluster, respectively, and are recorded on HDD3 with the Write command on the host interface bus 2 by turns. At once, HDD3 records only the cluster of one channel as well as the case of the two-channel simultaneous operation of above-mentioned drawing 5, advances record of three channels by turns, and goes.
[0056]In this case, as shown in drawing 6, HDD3 is busy with operation of seeking and record,

and idle time (E) becomes very short. Thus, when a disk recorder is simultaneously recorded or reproduced in the maximum number of channels that the speed performance of HDD3 allows, it is difficult to secure prolonged idle time.

[0057]The operation situation of HDD3 changes depending on the number of channels which the disk recorder is treating at the time so that explanation of the above disk recorder of operation may show. That is, in the example of the recorder in which a maximum of three-channel simultaneous record / reproduction is possible, although HDD3 has only slight idle time while carrying out three-channel simultaneous operation, in one-channel operation, remarkable idle time exists. In a actual operating condition, a disk recorder may be in the hibernation which it does not always continue operating, and the number of channels of operation certainly decreases, or is not recorded / reproduced at all with the number of the maximum possible channels. Since the system management software of a disk recorder grasps the operation situation of disk recorders, such as the number of channels of operation, the situation of the idle time of HDD3 can also grasp it.

[0058]So, in this invention, idle time or a quiescent period exists in HDD3 in a disk recorder, And in these idle time or a quiescent period paying attention to the system management software by the side of the host 1 grasping the situation of idle time, The host 1 controls so that HDD3 can perform the seeking retry described by the paragraph of the Prior art, a light retry, and a lead retry as much as possible.

[0059]For this reason, on the host interface bus 2, the command the host 1 instructs execution to be is established to a seeking retry, a light retry, and lead retry operation. By these commands, about a seeking retry, a light retry, and execution of lead retry operation, Host 1 and HDD3 is enabled to communicate, and a seeking retry required for the control of maintenance of the reliability of HDD3, a light retry, and lead retry operation can perform under the host's 1 management, as long as the operation situation of a disk recorder allows.

[0060]Below, the example of processing in case the host 1 manages execution is described about the seeking retry mentioned above, a light retry, and lead retry operation.

[0061]First, the 1st example of operation in the case of directing the number of times of permission of re-read-out when an error exists in the reproduced data from the host 1 is described.

[0062]For this reason, drawing 7 expresses the composition of the AV mode setting command 120 newly set up, and this command 120 is a command which sets up the operational mode in the writing of AV stream data, and read-out. The command identification code (for example, 85h) which specifies AV mode setting-operation is specified as the Command register 106. The data (parameter) 121 sent to HDD3 from CPU24 of the host 1 as data (parameter) of the command 120, It is constituted as shown in drawing 8, and read-out of AV stream data, writing, and various parameters that specify the operational mode at the time of seeking are contained

here. In this data 121, the retry time permitted to one command is specified at the time of reproduction and record. For example, in the example of drawing 8, the number of times of lead retry permission specifies the number of times of light retry permission as the byte 0 of the data 121, and it is specified as the byte 1 of the data 121, and the number of times of seeking retry permission is specified as the byte 2 of the data 121, respectively. As for other parameters, the graphic display is omitted in drawing 8.

[0063]When HDC31 and CPU38 in HDD3 receive the command 120 concerned and the parameter 121, it performs setting-operation of retry time as follows according to the flow chart shown in drawing 9. Although the parameter at the time of AV mode operation is contained in the operation parameters 121 besides retry time, these processings are not shown in drawing 9.

[0064]CPU38 changes the value of the variable of the retry maximum times about seeking, a lead, and a light memorized in an internal RAM area into the value to which it is directed with the parameter 121 of the command 120 (Step S11). CPU38 executes a light or a read command for the value of the variable concerned after this as a value of seeking, a lead, and the number of times of retry permission at the time of a light.

[0065]The host 1 can control the increase in the execution time per command by performing the above processings by specifying the number of times of retry permission per one command from the host 1.

[0066]CPU24 of the host 1 advances processing as follows according to the flow chart shown in drawing 10, when transmitting AV stream data between HDD3 using the AV mode setting command 120 defined as mentioned above.

[0067]CPU24 of the host 1 determines the retry time for carrying out record reproduction of the data of the predetermined number of channels into predetermined time in consideration of the present number of channels, idle time, a cluster size, etc. (Step S21). For example, what is necessary is just to write the data of 256 sectors in 0.125 second after being record of only one channel, and since there is much idle time E, retry time can be made to increase in the example of drawing 4 in the range which does not exceed idle time E. The example of drawing 6 is a case of simultaneous record of three channels, and there is less idle time E clearly than the case of drawing 4. In such a case, CPU24 will make judgment of lessening retry time.

[0068]Next, CPU24 of the host 1 publishes the command 120 and sets up the maximum retry time to HDD3 (Step S22). CPU24 repeats processing of Step S21 and S22, whenever change of execution environments, such as the number of record reproduction channels, idle time, and a cluster size, arises, and it sets up the optimal retry time (Step S23).

[0069]The number of times of permission of re-read-out when an error exists in the reproduced data is described below about the 2nd example of operation in the case of directing from the host 1.

[0070]Drawing 11 expresses the composition of the AV stream read command 122 which is newly defined for this reason. When executing a read command and performing AV stream data transfer, the acceptable value of retry time effective only in the command is specified, for example using the Feature register 100. In the command 122, like the standard read command for ATA, To the Sector Count register 101, a read-out sector number, A read-out start logic block address is specified as 4 bits of low ranks of the Sector Number register 102, the Cylinder Low register 103, the Cylinder High register 104, and the Device/Head register 105. In the command 122, the command identification code (for example, 86h) which shows AV stream data read processing is specified as the Command register 106.

[0071]When HDC31 and CPU38 in HDD3 receive the command 122 concerned, it performs read-out of AV stream data as follows according to the flow chart shown in drawing 12.

[0072]CPU38 shunts temporarily the value of the variable of the retry maximum times of a lead memorized in an internal RAM area to another field (Step S31). And while accessing the field on the disk 45 specified by the command 122 at the following step S33, The value of the variable which has memorized the retry maximum times of a lead is changed into the value of the number of times of retry permission specified with the Features register 100 of the command 122 (Step S32), and reading processing is performed (Step S33). If reading processing is completed, the value of the retry maximum times which shunted temporarily at Step S31 will be returned (Step S34).

[0073]It enables CPU24 of the host 1 to control command execution time by performing the above processings more finely by specifying the number of times of retry permission for every command from the host 1. A temporary retry time change is attained efficiently, without using the command 120 of drawing 7.

[0074]CPU24 of the host 1 advances processing as follows according to the flow chart shown in drawing 13, when transmitting AV stream data between HDD3 using the AV stream read command 122 defined as mentioned above.

[0075]CPU24 of the host 1 takes into consideration the present number of channels, idle time, a cluster size, etc. like the 1st example of operation, The retry time for carrying out record reproduction of the data of the predetermined number of channels is determined in predetermined time (for example, the example of drawing 6 0.125 second), and the command 120 is published (Step S41). In the command 121, when retry time is specified and the command 120 is published supposing the worst case where a retry occurs by all the commands, supposing a retry does not occur actually, idle time will increase as it approaches in the end of predetermined time. Then, when it is judged whether idle time changed (Step S42) and it changes, in the AV stream data read command 122 published in the end of the predetermined time concerned. Retry time can be increased temporarily and the probability of occurrence of a read error can be reduced (Step S43). When there is no change in idle time

(Step S42), the command 122 is published, without changing retry time (Step S44).
[0076]Drawing 14 expresses the composition of the AV stream write command 123 newly defined. When executing a write command and performing AV stream data transfer, the Feature register 100 is used, for example and the acceptable value of retry time effective only in the command is specified. Also in the command 123, like the standard write command for ATA, To the Sector Count register 101, the number of recording sectors, A recording start logic block address is specified as 4 bits of low ranks of the Sector Number register 102, the Cylinder Low register 103, the Cylinder High register 104, and the Device/Head register 105. In the command 123, the command identification code (for example, 87h) which shows AV stream data write processing is specified as the Command register 106.
[0077]When HDC31 and CPU38 in HDD3 receive the command 123 concerned, it processes record of AV stream data like the case in the command 122.
[0078]The example of drawing 15 expresses the composition of the AV stream read command 124 with which the number of times of seeking retry permission is also newly specified. When executing a read command and performing AV stream data transfer, for example by the command 122, used the Feature register 100 and only the acceptable value of lead retry time effective only in the command was specified, but. In the command 124, the number of times of lead retry permission is specified as top 4 bits of the Feature register 100, and the acceptable value of seeking retry time is assigned to 4 bits of low ranks. In the command 124, the command identification code (for example, 88h) which shows AV stream data read processing is specified as the Command register 106.
[0079]The read error can aim at relief to some extent by interpolating from the data of order. However, on the other hand, a seek error may cause the burst error in which it is huge since all the data of a target sector data constellation is not read correctly. Therefore, the reliability of the read command of a disk recorder improves by securing the acceptable value of seeking retry time from the acceptable value of lead retry time more greatly. Therefore, CPU24 is controlled to always make the acceptable value of seeking retry time larger than the acceptable value of lead retry time.
[0080]When HDC31 and CPU38 in HDD3 receive the command 124 concerned, it processes record of AV stream data like the case in the command 122.
[0081]The example of drawing 16 expresses the composition of the AV stream write command 125 with which the number of times of seeking retry permission is also newly specified. Here, like the command 124, the number of times of lead retry permission is specified as top 4 bits of the Feature register 100, and the acceptable value of seeking retry time is assigned to 4 bits of low ranks. In the command 125, the command identification code (for example, 89h) which shows AV stream data read processing is specified as the Command register 106. Thus, by specifying the acceptable value of seeking retry time, the reliability of the write command of a

disk recorder as well as the command 124 improves.

[0082]When HDC31 and CPU38 in HDD3 receive the command 125 concerned, it processes record of AV stream data like the case in the command 122.

[0083]Next, the 3rd example of operation in the case of directing the number of times of permission of re-read-out when an error exists in the reproduced data from the host 1 is described.

[0084]Also in the 3rd example, like the 1st and 2nd examples of operation, retry time is specified using the AV mode setting command 120 and the data 121, and retry time is temporarily changed for every command using the command 122. In addition to these, the retry status sense command 126 shown in drawing 17 is newly defined by the 3rd example of operation. In the command 126, the command identification code (for example, 90h) which shows retry status sense command processing is specified as the Command register 106. The command 126 is reported in the last lead and a write command as the status information 127 which shows drawing 18 how much time delays which the retry of data or seeking generated owing to occurred. In the status information 127, the delaying amount by delay by seeking retry and data retry is described by a second bit or 1 circumference time basis of the disk 45 as delay time information by retry, for example.

[0085]When HDC31 and CPU38 in HDD3 receive the command 126 concerned, it is advanced as follows according to the flow chart which shows drawing 19 a report of the delay information which the retry produced owing to with the lead performed immediately before or a write command.

[0086]CPU38 measures the time delay generated in a lead and write command processing during execution of a command (for example, the example of drawing 13 step S43 or S44), and memorizes it in the memory to build in. CPU38 will be notified to CPU24 of the host 1 by making the time delay concerned into the status information 127, if the command 126 is received (Step S51). By publishing the command 126 from the host 1 by performing the above processings, CPU24 of the host 1 can grasp the delay time information by the actually generated retry, and it becomes possible to control finely the number of times of retry permission in subsequent commands.

[0087]When CPU24 of the host 1 transmits AV stream data between HDD3 using the lead for AV and the write command 126 which were defined as mentioned above, according to the flow chart shown in drawing 20, processing is advanced as follows.

[0088]CPU24 of the host 1 takes into consideration the present number of channels, idle time, a cluster size, etc. like the 1st and the 2nd example of operation, The retry time for carrying out record reproduction of the data of the predetermined number of channels is determined in predetermined time (for example, the example of drawing 4 0.125 second), the command 120 is published, and the maximum retry time is set up (Step S61). Next, CPU24 publishes the

command 122, reads data (Step S62), succeedingly, publishes the command 126 and obtains the delay information produced during execution of the command 122 concerned (Step S63). When the status information 127 corresponding to the command 126 comes to hand from HDD3, idle time is re-calculated based on delay information (Step S64). The idle time re-calculated here is referred to at the time of the determination of retry time, when publishing the following command 122.

[0089]In above three embodiments, although explained having set up the maximum allowable number of each retry as a limiting method of a retry, though the maximum-permissible time of each retry is set up as the 2nd limiting method, it is good.

[0090]Although the magnetic disk (hard disk) was explained above as an example as a recording medium, this invention can be applied also to recording media, such as optical discs other than a magnetic disk, and a magneto-optical disc.

[0091]It cannot be overemphasized that this invention is applicable also in the magnetic disk drive of removable HDD with an exchangeable disk or others.

[0092]In this specification, a system shall show the overall device which comprises two or more devices.

[0093]As a distribution medium which provides a user with the computer program which performs processing which was described above, communication media, such as a network, a satellite, etc. besides recording media, such as a magnetic disk, CD-ROM, and solid-state memory, can be used.

[Translation done.]

DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]
[Drawing 1]It is a block diagram showing the composition of the digital image disk recorder which applied this invention.
[Drawing 2]It is a block diagram showing the example of composition of the software of CPU24 by the side of the host 1 of drawing 1.
[Drawing 3]They are a cluster which is a data unit of record/reproduction, and a figure showing the relation of GOP in MPEG 2.
[Drawing 4]It is a timing chart which shows operation of HDD in the case of recording one AV information stream.
[Drawing 5]It is a timing chart which shows operation of HDD in the case of recording / reproducing two or more AV information streams simultaneously.
[Drawing 6]It is a timing chart which shows operation of HDD in the case of recording / reproducing three AV information streams simultaneously.
[Drawing 7]It is a figure showing the format of an AV mode setting command.
[Drawing 8]It is a figure showing the format of AV mode setting parameters.
[Drawing 9]It is a flow chart explaining AV mode setting command processing of HDD3 of drawing 1.
[Drawing 10]It is a flow chart explaining AV mode setting command processing of the host 1 of drawing 1.
[Drawing 11]It is a figure showing the format of an AV stream read command.
[Drawing 12]It is a flow chart explaining AV stream read command processing of HDD3 of drawing 1.
[Drawing 13]It is a flow chart explaining retry time specification processing of the host 1 of drawing 1.
[Drawing 14]It is a figure showing the format of an AV stream write command.

[Drawing 15]It is a figure showing the format of an AV stream read command (number-of-times specification of seeking retry permission).
[Drawing 16]It is a figure showing the format of an AV stream write command (number-of-times specification of seeking retry permission).
[Drawing 17]It is a figure showing the format of a retry status sense command.
[Drawing 18]It is a figure showing the format of retry status information.
[Drawing 19]It is a flow chart explaining retry status sense command processing of HDD3 of drawing 1.
[Drawing 20]It is a flow chart explaining retry time specification processing of the host 1 of drawing 1.
[Description of Notations]
1 A host and 3 A hard disk drive, 11-1,11-2 AV encoder and 16-1,16-2. An AV decoder, 24 CPU, and 31 [A head, 37 channel-reproduction digital disposal circuit 38 CPU, and 40 / Servo DSP and 45 / Disk] A hard disk controller and 32 A buffer memory and 33 A record channel signal processing circuit and 35

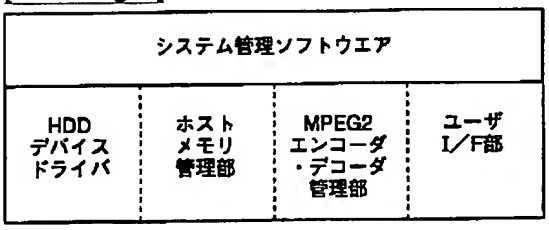
[Translation done.]

* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

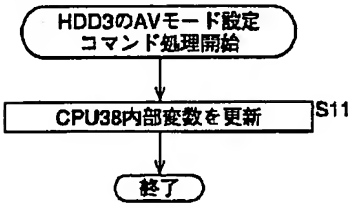
DRAWINGS

[Drawing 2]

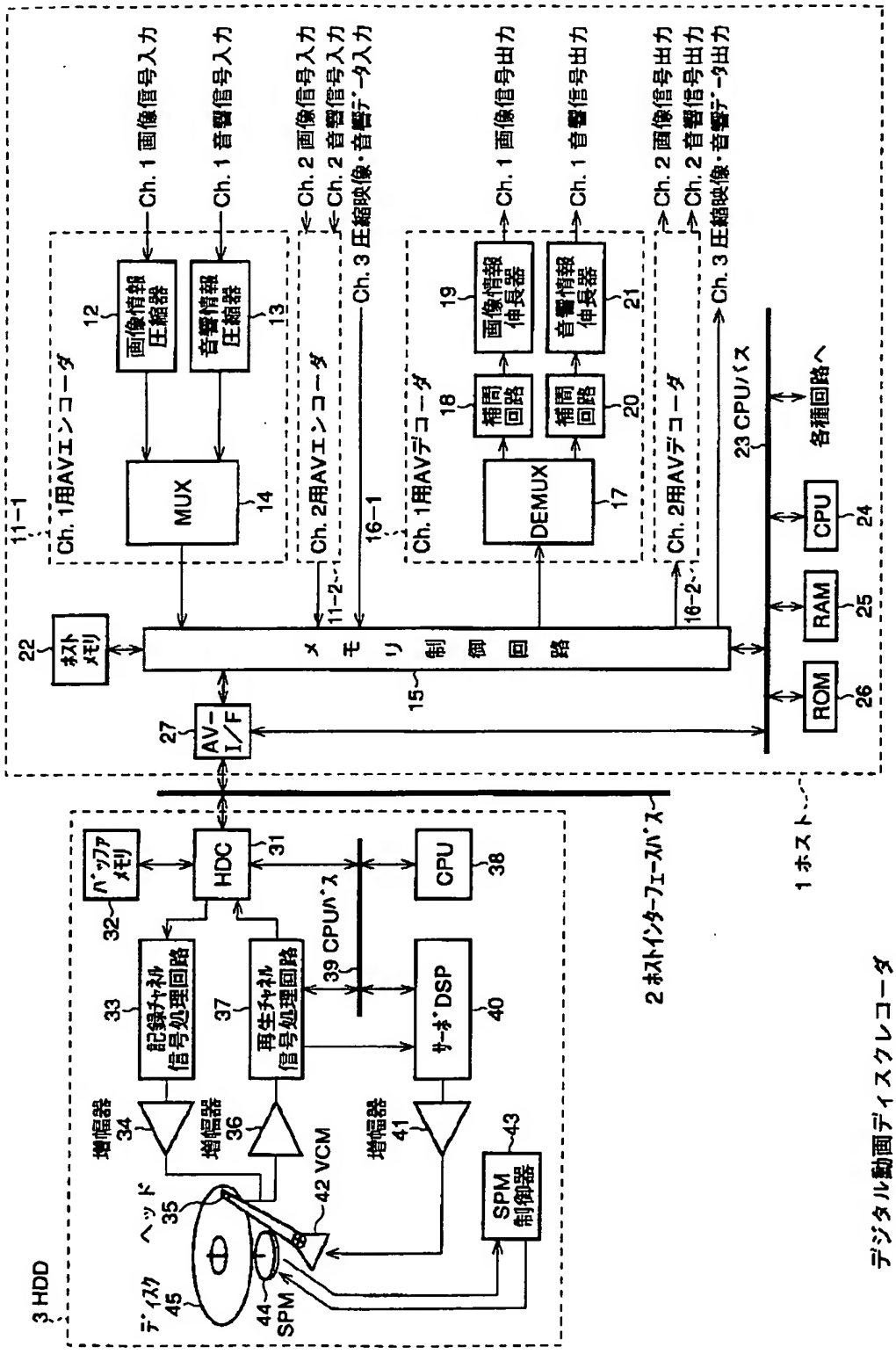


ホストのファームウエアの構成

[Drawing 9]

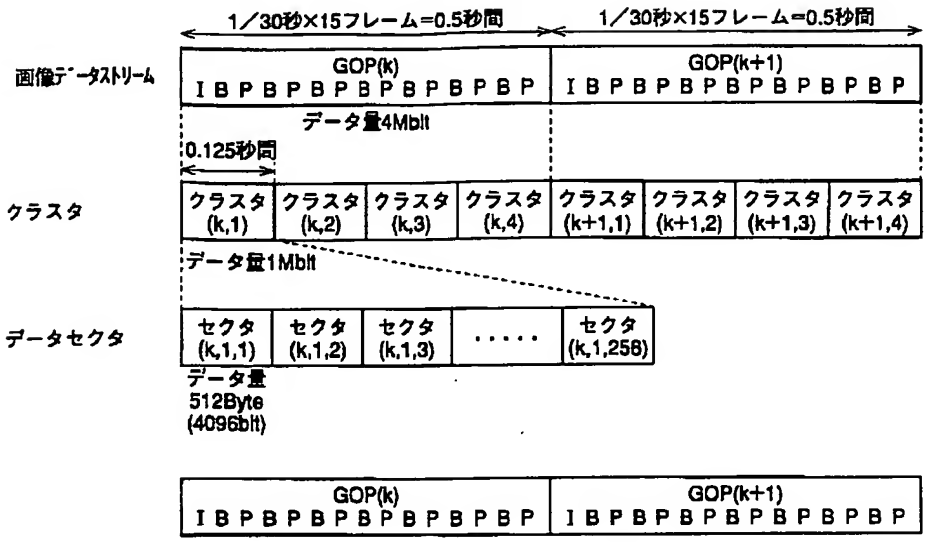


[Drawing 1]



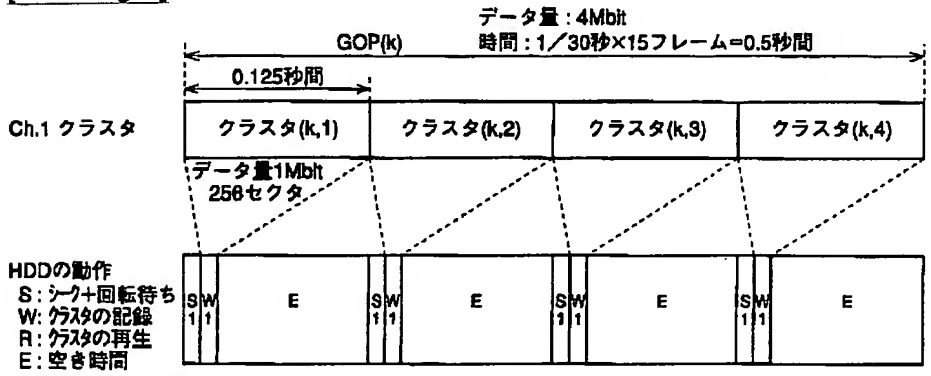
デジタル動画ディスクレコーダ

[Drawing 3]



クラスタとMPEG2のGOPの関係

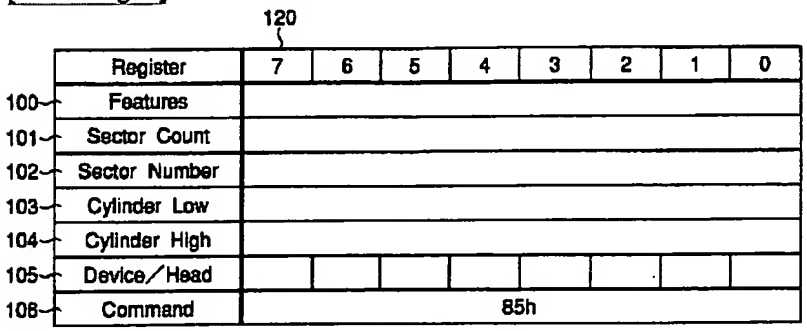
[Drawing 4]



添え数字はチャネル番号

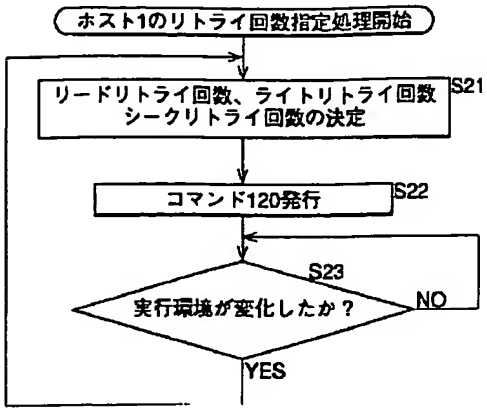
1本のAVデータストリームを記録する場合のHDDの動作
(MPEG2、8Mbit/sの場合、Ch. 1は記録、Ch. 2とCh. 3は休止)

[Drawing 7]

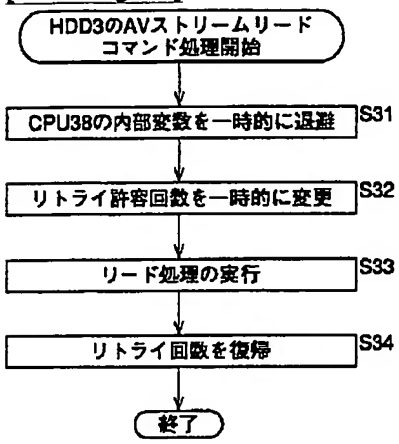


AVモード設定コマンド

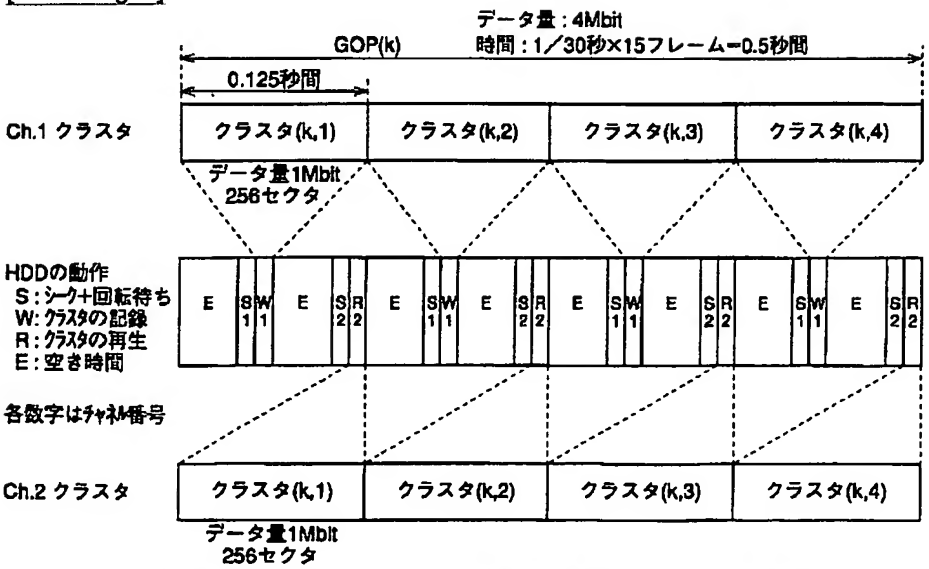
[Drawing 10]



[Drawing 12]

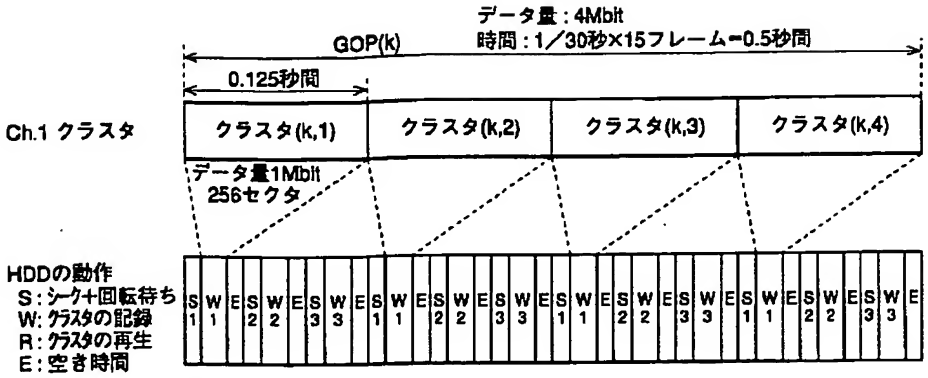


[Drawing 5]



複数のAVデータストリームを同時に記録／再生する場合のHDDの動作
(MPEG2、8Mbit/sの場合、Ch. 1は記録、Ch. 2は再生の場合)

[Drawing 6]



3本のAVデータストリームを同時に記録する場合のHDDの動作
(MPEG2、8Mbit/sの場合、Ch. 1、Ch. 2、Ch. 3共に記録)

[Drawing 8]

121

Byte	7	6	5	4	3	2	1	0
0	リードリトライ許容回数							
1	ライトリトライ許容回数							
2	シークリトライ許容回数							
3								
4								
5								
6-511								

AVモード設定パラメータ

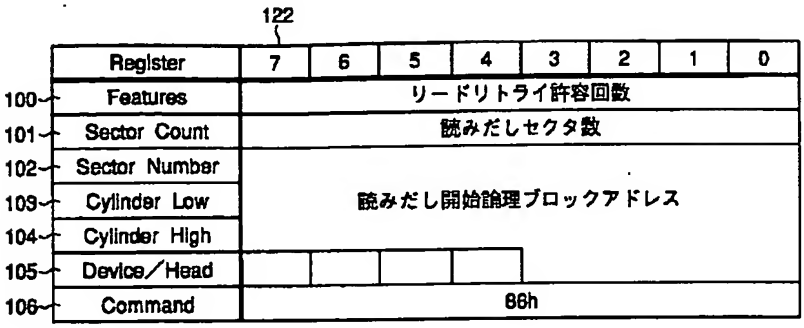
[Drawing 18]

127

Byte	7	6	5	4	3	2	1	0
0	遅延情報							
1								
2								
3								
4								
5								
6-511								

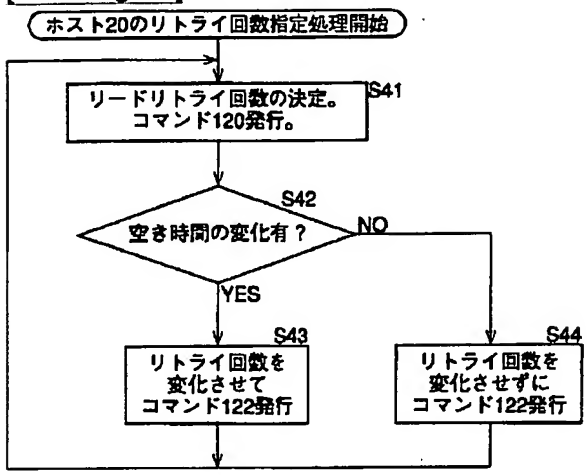
リトライステータス情報

[Drawing 11]

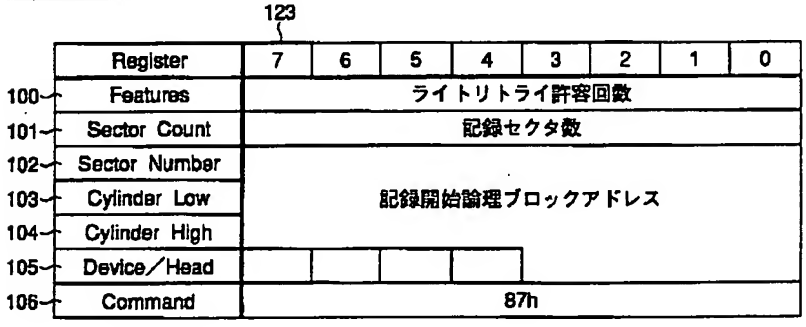


AVストリームリードコマンド

[Drawing 13]

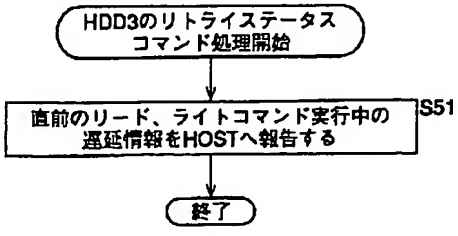


[Drawing 14]

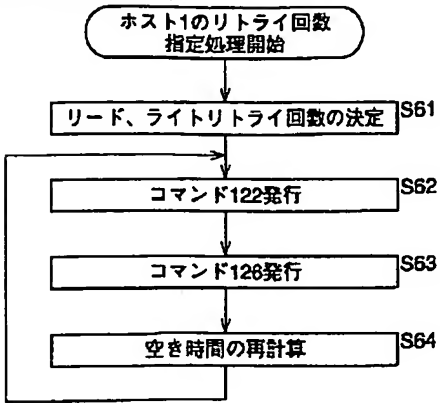


AVストリームライトコマンド

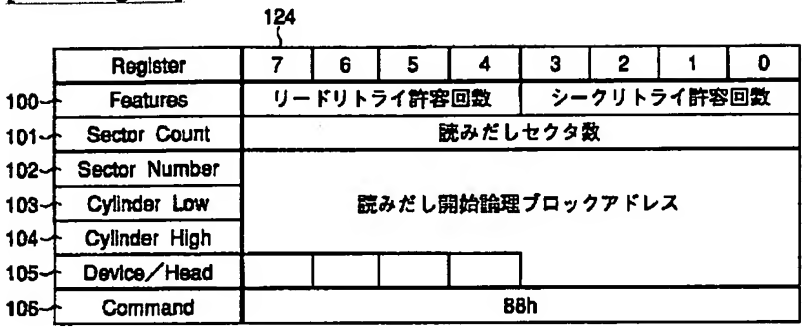
[Drawing 19]



[Drawing 20]

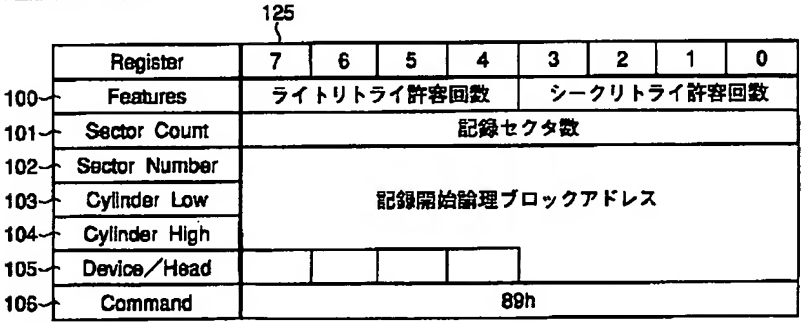


[Drawing 15]



AVストリームリードコマンド(シークリトライ許容回数指定)

[Drawing 16]



AVストリームライトコマンド(シークリトライ許容回数指定)

[Drawing 17]

126

	Register	7	6	5	4	3	2	1	0
100	Features								
101	Sector Count								
102	Sector Number								
103	Cylinder Low								
104	Cylinder High								
105	Device/Head								
106	Command	90h							

リトライステータスセンスコマンド

[Translation done.]